

**What do you think? Associations between social anxiety, mentalizing, and social competence in middle childhood.**

by

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The following is the Examining Committee for this thesis.

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### **Author's Declaration**

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## **Statement of Contributions**

Emma S. Green was the sole author for Chapters One and Five which were written under the supervision of Dr. Heather Henderson and were not written for publication.

This thesis consists in part of three manuscripts written for publication. Exceptions to sole authorship of material are as follows:

### **Research presented in Chapter Two:**

This research was conducted at the University of Waterloo by Emma S. Green under the supervision of Dr. Heather Henderson. Emma S. Green designed the study with consultations from Drs. Heather Henderson and Sebastian Dys, who contributed to data analysis. Emma S. Green drafted the manuscript and each author provided intellectual input on manuscript drafts.

### **Research presented in Chapter Three:**

This research was conducted at the University of Waterloo by Emma S. Green under the supervision of Dr. Heather Henderson. Emma S. Green designed the study with consultations from Dr. Heather Henderson. Emma S. Green drafted the manuscript and received intellectual input from Dr. Heather Henderson.

### **Research presented in Chapter Four:**

This research was conducted at the University of Waterloo by Emma S. Green under the supervision of Dr. Heather Henderson. Emma S. Green designed the study with input from Claudia Labahn in the creation of the coding scheme for the dyadic data, and data coding. Emma S. Green drafted the manuscript and received intellectual input from Dr. Heather Henderson.

As lead author of these four chapters, I was responsible for contributing to conceptualizing study design, carrying out data collection and analysis, and drafting and submitting manuscripts. My coauthors provided guidance during each step of the research and provided feedback on draft manuscripts.

## Abstract

Every individual brings a unique perspective and understanding to the social world that they inhabit. This is particularly true of socially anxious children, who view their social environments as a place of potential evaluation and rejection. This fearful and negative outlook not only impacts their internal processing of information, but their day-to-day social behaviours and long-term socio-emotional wellbeing. Across three studies, the findings of this dissertation demonstrate that children's self-reported social anxiety is associated with the ways they perceive (emotion identification) and reason about (mentalizing) others' emotions, and that styles of mentalizing are associated with children's real-world styles of interacting with new peers. Chapter Two examined the longitudinal associations between social anxiety and two aspects of social information processing in middle childhood: identification of and mentalization about others' emotional expressions. At 7 years of age, social anxiety was associated with greater accuracy in identifying others' dynamic emotion displays and a tendency to over mentalize regarding the reasons for others' emotions. Importantly, 8-year social anxiety was predicted by a combination of higher social anxiety at 7 and both under or over mentalizing biases at 7. The findings of this chapter demonstrate that (a) social anxiety is associated with children's ability to identify socially relevant information in others' dynamic emotional expressions and (b) both over- and under-mentalizing biases can exacerbate already heightened levels of social anxiety in middle childhood. Chapter Three extended the work in Chapter Two by examining children's mentalizing about others' evaluations of themselves in social contexts, investigating whether children's expectations of others' social evaluations mediate the link between social anxiety and self-esteem. The results of this study demonstrated that there was a direct association between social anxiety at 7 and later self-esteem; however, there was also an indirect effect such that higher social anxiety at age 7 was associated with a negative bias in expectations of others'

social evaluations at age 8 and this negative bias was in turn related to lower self-esteem. The results of this chapter suggest that negative expectations about others' evaluations are a critical mechanism linking children's social anxiety and their socio-emotional functioning. Chapter Four extended the findings of Chapter Three to examine the relations between social anxiety, mentalizing, and children's real-world social engagement, via detailed observations of children's behaviour during an unstructured interaction with an unfamiliar peer in the lab. This study extended prior research by examining the implications of within-child factors for not only their own social behaviour, but those of their peer as well. The results of the study demonstrated that, while there was no association between social anxiety and either mentalizing or social engagement, children's expectations of negative evaluations by peers were associated with lower levels of social engagement with an unfamiliar peer. This finding demonstrates that children's expectations about others' evaluations impact their moment-to-moment responses in real-world social contexts. Taken as a whole, this dissertation provides evidence that children's social anxiety tendencies affect the way they process social information which impacts real-world social behaviour and broader emotional functioning in middle childhood.

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## **Dedication**

To everyone who has supported, encouraged, and loved me: we did it, we did it, we did it.

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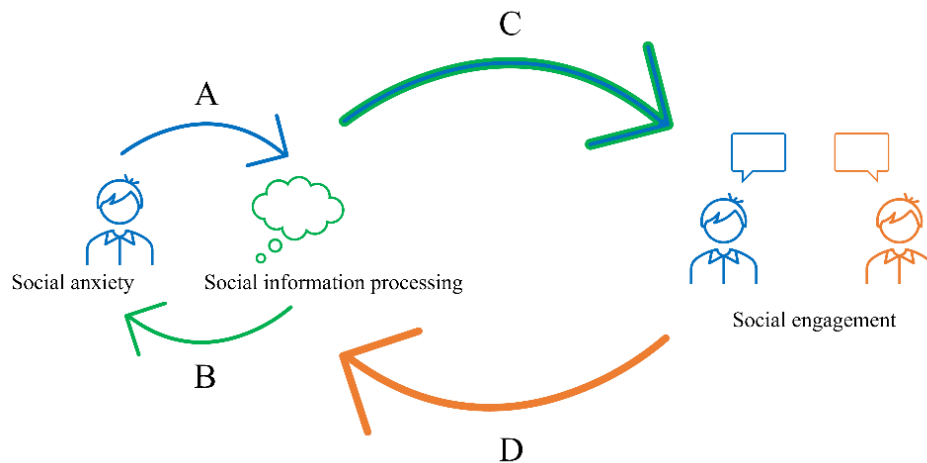
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## **Chapter One: Introduction**

### **Background**

The goal of my program of research is to understand the associations between socially anxious traits, mentalizing, and social/emotional development in middle childhood. This program of research blends temperament theory (Kagan, 2013; Rothbart et al., 2001) and SIP theory (Crick & Dodge, 1994) and is guided by the following assumptions: (a) temperament guides social attention, (b) social attention guides the perception and interpretation of social cues, and (c) social attention and interpretations of social cues impact the quality of social interactions. Specifically, as outlined in Figure 1, I hypothesized that children's temperament (specifically social anxiety) shapes how they view the world around them (Path A) and that these styles of processing social information, in turn, feedback to shape social anxiety and self perceptions over time (Path B). Further, I hypothesized that consistent with SIP theory, children's temperament and social information processing impact the quality of their social interactions by affecting their own behaviour and the behaviours of their social partners (Path C). Social interactions, particularly with peers, are hypothesized to provide a critical source of feedback that further shapes children's temperament and their perceptions of themselves and others over the course of development (Path D).



*Figure 1.* Conceptual model guiding dissertation studies.

Paths A through C of this conceptual model are examined in three studies that comprise my dissertation. I addressed paths A and B by first examining (a) the concurrent association between children’s social anxiety and their styles of reasoning about others’ socio-emotional displays and (b) how social anxiety and styles of reasoning about others were associated with social anxiety over the course of a year (Chapter Two). In Chapter Three, I extended this model to examine how social anxiety was related to children’s expectations of others’ evaluations of them in social contexts and how these expectations were, in turn, associated with self-esteem (paths A and B). Finally, in Chapter Four, I addressed Path C by examining how children’s social anxiety and expectations of others’ evaluations of them were associated with children’s own social engagement, and the engagement of an unfamiliar peer, during a live dyadic interaction in the lab.



## Background Theory and Rationale

### Theoretical Background: Social Information Processing Theory

Social Information Processing (SIP) theory describes the interpersonal and cognitive factors involved in processing social cues that are used to generate appropriate and successful social responses (Crick & Dodge, 1994). During all social interactions, partners present a host of informational cues through various modalities such as vocal tone and words, facial expressions, and body language. SIP describes how individuals attend to, perceive, interpret, and respond to others' cues.

In their SIP model, Crick and Dodge (1994) describe the successive steps of identifying, interpreting, and reacting to others' cues. This model is interpersonal, dynamic, and cyclical: a child takes in information, processes it, and reacts accordingly. Their social partner then processes the child's social cues, informing their own reactions. This dynamic process continues until the social interaction ends. *Encoding* of cues is the first step of the SIP model, in which children identify their social partner's cues. Next, children *interpret* their partner's cues by reasoning about why their partner has demonstrated or shared those specific cues. Then children decide on their goals for the social interaction and then how they will respond to their partner. The final step of the cycle is when children enact their chosen response, hopefully implementing a successful response resulting in a positive and continued interaction with their partner. According to the SIP model, each child enters social interactions with a unique '*database*' consisting of the child's accumulated memories of past social experiences and their own past interpretations which are shaped over the course of development by their unique constellation of traits. This database functions as a child's '*default mode*' of responding at each stage of the SIP model and provides guidelines for navigating current social engagement opportunities.

While the original SIP model was designed to provide an explanation for the way children’s own hostile attribution style influenced their interpretation of the social world (Crick & Dodge, 1994), this model can also be used to understand children with other social tendencies including those who experience social withdrawal and anxiety in novel contexts (Lane & Bowman, 2021). In my dissertation, I focused on the role of children’s social anxiety as a unique characteristic that shapes the development of the database and the child’s resultant biases for identifying, interpreting, and behaving in response to social cues (see Figure 2). From this perspective, socially anxious traits may shape children’s SIP database and therefore influence their encoding, mentalizing, and behavioural responses to others’ social cues.

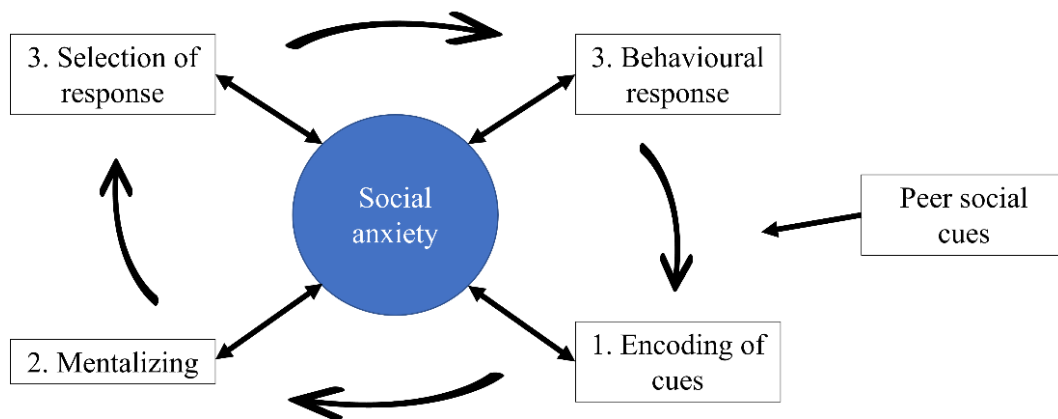


Figure 2. Adapted social information processing model.

### Developmental Origins of Social Anxiety in Children.

There are many pathways contributing to the development of social anxiety in childhood (e.g., biological, familial, social experiential learning etc.; Clauss & Blackford, 2012; Poole et al., *in press*). I am particularly interested in the temperamental origins of social anxiety.

Temperament describes biologically based, relatively stable, individual differences in patterns of

reactivity and regulation that are present from birth (Kagan, 2013; Rothbart et al., 2001). Of particular interest to my program of research are individual differences in reactions to novelty which range from high levels of approach to high levels of inhibition/withdrawal. From as early as 4 months of age, infants vary widely in the valence and intensity of their reactions to novel social and non-social stimuli (Fox et al., 2005). While some infants eagerly approach novel stimuli expressing excitement and laughter, others experience intense distress and actively try to move away from novel stimuli (Rothbart et al., 2001).

As children age, individual differences in reactions to novelty are primarily expressed in social contexts (Coplan et al., 1994). By toddlerhood, infants who responded with intense negative reactions begin displaying a pattern of social wariness where they stay on the periphery of new social environments. In middle childhood, the reaction to novelty is no longer purely a behavioural reaction; children are now cognitively aware of social contexts, and experience a pre-emptive fear impedes their ability to engage with their peers in a confident manner (Coplan et al., 2004). Importantly, many lines of research have demonstrated that this wariness does not mean children do not *want* to be involved in social interactions with others. Rather, socially wary children are described as experiencing a motivational approach-withdrawal conflict, in which they want to be involved in social interactions with others (approach) but are simultaneously fearful of being ignored or rejected by their peers (withdrawal; Asendorpf, 1990). This approach-withdrawal conflict is apparent in their behaviours in novel social environments: socially wary children tend to stay on the periphery of a new social setting, spending less time engaging with others and more time carefully observing (Rimm-Kaufman & Kagan, 2005). In sum, social withdrawal is the behavioural tendency to isolate oneself from a peer group due to internal factors such as a fear of negative evaluation or rejection (Asendorpf & Rubin, 1993).

As children age, the experience of social withdrawal becomes more oriented towards the fear of others' social evaluation and the stress of social interaction, or the experience of 'self-conscious shyness' (Crozier, 1995). This is a pre-emptive fear of social settings, discomfort during social interactions, and a preoccupation with how one is perceived and judged by others, also known as social anxiety (American Psychiatric Association, 2013). In an examination of the literature, there is an argument that the concepts of social withdrawal, shyness, and social anxiety should not be held separate from one another as categorical definitions but instead be viewed as a continuum (Brook & Willoughby, 2017). In investigating self-report measures of shyness and social anxiety and testing an adult population, Brook and Willoughby (2019) identified that scales for each construct were moderately to highly correlated, suggesting one general underlying latent construct. This core of this underlying construct includes a fear of negative evaluation, self-consciousness, and interaction anxiety. Therefore, many measures of social anxiety and shyness are likely to evaluate the same underlying construct. For example, the Child Shyness Questionnaire (CSQ; Crozier, 1995) is a measure of child temperament shyness and asks children to report whether "*[They] find it hard to talk to someone I don't know*". The Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1996) is meant to be a measure of child anxiety with a subscale of social anxiety and asks children to report whether "*It is hard for me to talk to someone I don't know well*". Both measures ask very similar questions and, as Brook and Willoughby (2019) posit, it is likely that individuals will respond similarly on either measure despite one being a measure of shyness and the other a measure of anxiety, with higher scores indicating more severe experience of social fearfulness/anxiety. As discussed before, social withdrawal/shyness tends to be more in the moment and reactionary, whereas social anxiety tends to be pre-emptive and involves more cognitive preoccupation with the thoughts of

others. It is for this reason that I am specifically focusing on an assessment of social anxiety (American Psychiatric Association, 2013; Crozier, 1995). For my dissertation, and consistent with past studies examining trait anxiety in community samples of children (Hawes et al., 2021; Poole & Schmidt, 2021), I relied upon children's self-reported social anxiety on the SCARED to characterize trait differences in social anxiety (Birmaher et al., 1996).

### **Mentalizing and Social Competence**

Mentalizing is the process of reasoning about others' social cues and relies on understanding that others have intentions and thought processes that differ from our own (Sabbagh, 2004; Wellman, 1992). Understanding these intentions and thoughts allows an individual to anticipate potential reactions to, and consequences of, their own behaviours during social interaction. Successful mentalizing requires the ability to take others' perspectives and to reason about others' mental states and motivations. In young children, mentalizing begins with the understanding that others hold unique mental states. This is often tested through first-order false belief tasks, where successful performance requires a child to demonstrate perspective taking, an understanding that other people may think differently than the child themselves (i.e., *What do you think Matilda thinks is in the box? Why?*; Wellman, 1992). By age four to six, almost all children can achieve this level of mentalizing (Wellman & Liu, 2004), and the tasks begin to turn to those of second-order theory of mind where children mentalize about what others think about another individual's thoughts, requiring multiple levels of perspective taking (i.e., *What do you think Molly will think about Matilda not knowing where to look?*; Wellman, 1992).

With age, children gain more understanding of the social world and their role within it. First- and second-order theory of mind addresses children's understandings of the different thoughts and perspectives of others, however, children must also begin to consider how they

themselves are represented in others' thoughts. Others' feedback is central to children's development of a self-concept, and their evaluation of the self. As hypothesized in Cooley's original "looking glass self" theory (1902) individuals build up their representations of self based on the information received from others during social interactions. As such, one's self-esteem is influenced by actual, or perceived, positive and negative feedback from others (Harter, 2006; Miers et al., 2009). An adaptation of the previously mentioned theory of mind tasks addresses this form of perspective taking. In these tasks, children attempt to mentalize about what others think about themselves (i.e., *What do I think Matilda thinks about me?*; Sharp et al., 2007). This type of mentalizing is particularly important for children's developing self-concept and social self-esteem (Harter, 2012; Sharp et al., 2007; Usher et al., 2018) .

In general, the ability to accurately identify and reason about others' social cues is positively associated with social competence, as supported by evidence from studies such as Caputi et al. (2012): children who better understand others' emotions at age 5 demonstrate more prosocial behaviour and experience greater peer acceptance at age 7. Additionally, greater false belief *mis*understanding has been found increases the magnitude of the association between early behavioural inhibition and later social anxiety (An & Kochanska, 2021). However, several recent studies suggest that greater false belief understanding may come at cost for some children, especially for children prone to experiencing social anxiety. Young infants with fearful temperaments display earlier and more sophisticated false belief abilities in preschool (Mink et al., 2013). However, children with earlier developing or greater false belief abilities have also been found to spend more time engaging in watchful and wary behaviour with peers (Moore et al., 2011), to be more sensitive to perceived criticism from teachers (Cutting & Dunn, 2002), and to be less willing to perform activities such as singing and dancing in front of others (Chaplin &

Norton, 2015). Similar associations between enhanced mental state reasoning and social anxiety have been documented in adults. Specifically, when interpreting social stimuli, such as facial expressions or intentions communicated through speech and subtext, adults with social anxiety display a pattern of over mentalizing, or excessive interpretation of social information, in which the individual draws conclusions beyond the presented social information (Hezel & McNally, 2014; Washburn et al., 2016). The directions of effects are not clear: adult literature hypothesizes that a history of preoccupation with the thoughts of others' leads to social anxiety but it is also possible that socially anxious adults develop a style of over mentalizing due to their social anxiety (Hezel & McNally, 2014). Consistent with the first hypothesis, children high in social anxiety who demonstrate biased emotion identification and mentalizing are more likely to develop clinical social anxiety disorder (Nikolić, 2020). Still, further developmental research into the lifespan connections between social anxiety and mentalizing are necessary.

For socially anxious children, excessive mentalizing may be detrimental for the development of social competence, as social competence requires not only understanding others' social cues but also the ability to respond appropriately, quickly, and flexibly in response to these cues (Semrud-Clikeman, 2007). It may be that engaging in high levels of reasoning about others' mental states poses another barrier to fluid, reciprocal interactions for socially anxious children who are already reticent when interacting with unfamiliar others (Rimm-Kaufman & Kagan, 2005). Importantly, beyond the impact of anxiety and excessive mentalizing on a child's own behaviour, their reticent behaviour may lead their peers to believe they are disinterested in interaction or unwilling to interact, leading others to form negative perceptions (Coplan & Arbeau, 2009). Consistent with this, adolescents tend to believe that their socially anxious peers demonstrate a deficit in social skills (Miers et al., 2010), resulting in lower levels of peer

acceptance (Greco & Morris, 2005). The subtle (and sometimes not subtle) communication of these negative perceptions may create a vicious cycle in which anxious children notice and internalize others' negative evaluations, thereby worsening their fear of negative evaluation in the future and increasing anxiety over time.

As put forward in the SIP model (Crick & Dodge, 1994), identification and reasoning about social cues are key to successful social engagement. Specifically, children's social behaviours are guided by how they identify, label, and interpret their social partners' cues. This cyclical interplay between information processing and behaviour happens over multiple units of time (e.g., moment-to-moment versus year over year) and is critical for the development of social competence. Children (and adults) exist in a world surrounded by others and their ability to successfully engage and manage interactions with others is associated with numerous positive outcomes (Luecken, 2013). For example, children who are reported (by themselves and their peers) to experience positive social interactions are more likely to report higher self-esteem and lower loneliness (Antonopoulou et al., 2019). Positive social relationships with peers and successful social interactions are also protective against the later development of depressive symptoms in school-aged children (Schrepferman et al., 2006). Conversely, children who display poor social skills as observed by others experience poorer friendship quality and are at higher risk for peer victimization (Crawford & Manassis, 2011).

Socially competent individuals quickly and accurately understand others' perspectives, allowing them to respond appropriately and flexibly to their interaction partners' cues (Semrud-Clikeman, 2007). The SIP model provides a developmental perspective on social competence by ascribing a critical role to past experiences in how children process social information in the moment and how they predict others' future reactions and behaviours (Crick



& Dodge, 1994). Each child maintains their own memory or recollection of previous social interactions and information, stored in a personalized mental database. This unique database can be drawn upon in times of high or low stress, guiding children's behaviour based upon the availability of relevant information from the surrounding social world (Verhoef et al., 2021). In this regard, children prone to social anxiety may, over time, build up a unique SIP database, drawn from their past experiences of carefully observing peers in social contexts, which may in turn shape their current ways of processing social cues, their predictions about others, and their style of engaging with others (paths B and C, Figure 1).

### **Dissertation Studies**

Inspired by Crick & Dodge's (1994) SIP model, I structured my dissertation to investigate the inter-relations between children's social anxiety, their SIP styles, and their socio-emotional functioning, with a particular focus on the mentalizing component of SIP.

In the first study of my dissertation (Chapter Two), I examined how children's self-reported social anxiety was associated with their identification of others' emotions, as well as their interpretations (mentalization) of others' emotional displays (path A and path B, Figure 1). Of particular interest was how these social information processing tendencies related to self-reports of social anxiety over the course of a year. I drew on the adult literature that found that individuals with social anxiety demonstrate improved emotion identification skills and excessive mentalizing relative to non-anxious adults (Hezel & McNally, 2014; Washburn et al., 2016). I hypothesized that higher levels of self-reported social anxiety would be associated with better emotion identification skills, but also a tendency to over mentalize regarding the reasons for others' emotional displays. Additionally, I hypothesized that children with high social anxiety

*and* an over mentalizing bias at seven years would report the highest levels of social anxiety one year later at age eight.

In Chapter Three, the second study of my dissertation, I expanded my assessment of mentalizing to examine children's expectations regarding others' evaluations of them in potentially stressful peer-related scenarios (path A, Figure 1). Furthermore, I investigated how these expectations of others' social judgments were associated with earlier self-reported social anxiety and concurrent self-esteem (path B, Figure 1). Assessing these expectations taps into the database component of the SIP model where children's history of interactions informs their expectations for future judgments by others in a social context and impacts their self-esteem. The basis of this research is guided by previous research that has found that socially anxious adolescents' hold negative expectations of others' evaluations following a speech task, regardless of their actual performance (Miers et al., 2009). Therefore, I also investigated how children's social anxiety and expectations regarding others' evaluations of them were related to overall self-esteem. I predicted that higher levels of self-reported social anxiety at age seven would be associated with more negative expectations of others' evaluations at age eight. I further hypothesized that children who reported more negative expectations of others' evaluations would also experience lower self-esteem. Finally, I hypothesized that there would be an indirect effect of social anxiety on self-esteem, that is, that expectations of negative evaluations by others, would partially mediate the relation between earlier social anxiety and later self-esteem.

Lastly, in Chapter Four and the final study for my dissertation, I extended my previous studies to examine how social anxiety and expectations of others' evaluations impacted 9- to 11-year-old children's behaviour during an in vivo social interaction with an unfamiliar peer (path C and path D, Figure 1). This extended the previous two chapters by linking social anxiety and SIP

tendencies to the quality of children's peer interactions, reflecting the fact that the SIP model was designed to account for variability in moment-to-moment interactions with peers. Critically, this work tested the hypothesis that social anxiety and expectations of others' evaluations not only change a child's own behaviour, but also the behaviours of their interaction partners.

Specifically, I predicted that children who report higher levels of social anxiety, and their social interaction partners, would display lower levels of social engagement and less reciprocity during a live peer interaction and that this effect would be mediated in part through negative expectations regarding peers' evaluations.

## **Chapter Two: The associations between social anxiety and social information processing in middle childhood.**

Portions of these data were previously presented:

Green, E.S., & Henderson, H.A. (November, 2020). *The role of shyness and social anxiety in childhood emotion identification and reasoning*. Poster session presented at the 23<sup>rd</sup> Occasional Temperament Virtual Conference, Blacksburg, VA.

Children high in social anxiety experience a vicious cycle where social experiences cause distress that leads them to withdraw from social interactions thereby creating additional anxiety about future social interactions. Still, socially anxious children are not disinterested in social interactions: they spend a great deal of time thinking about others, as evidenced by the amount of time they spend observing others without engaging in social interaction (Asendorpf, 1990, 1993). It is unclear, however, whether different patterns of thinking about others play a role in maintaining or exacerbating pre-existing social anxieties. I sought to examine how emotion identification (EI) and mentalizing – reasoning about another’s state of mind – were concurrently and longitudinally associated with social anxiety in middle childhood. I focused on seven- and eight-year-old children for two primary reasons: (1) the heightened significance of social information from peers and the resultant potential for evaluation from others during middle childhood (e.g., Chaplin & Norton, 2015; Coplan et al., 2004), and (2) the emergence of higher order theory of mind abilities (Arslan et al., 2017).

Social anxiety is characterized by a pervasive and preemptive fear of social encounters, and the risk of potential judgement or exclusion from others (American Psychiatric Association, 2013). However, this fear does not diminish an individual’s interest in social encounters:

individuals who experience social anxiety still want to engage with others but are held back by their fear (Rimm-Kaufman & Kagan, 2005). When in social contexts, children with high levels of social anxiety tend to stay on the periphery carefully observing others. This preoccupation with others is hypothesized to impact their perceptions of others' judgements (Washburn et al., 2016), and in turn, perceptions of others' evaluations affect children's own sense of self and self-esteem (Harter, 2006).

To interact with others, individuals must be able to understand the perspectives and reactions of others, through a process known as Social Information Processing (SIP; Crick & Dodge, 1994). The initial SIP steps are (1) *decoding* or identifying others' mental states and (2) *mentalizing* or interpreting the cause of others' emotional states (Sabbagh, 2004; Wellman, 1992). Being able to accurately analyze the behaviours and intentions of others is a critical social tool that allows individuals to dynamically respond to others and navigate the social world. It has been shown that individual differences in understanding others' mental states are concurrently associated with preschool children's observed social engagement with peers (Moore et al., 2011). Further, the association between mentalizing and social competence appears to be reciprocal. For example, more experience in social settings is associated with more advanced false belief understanding (a standard early test of mental state mentalizing) in school-aged children and, in turn, this understanding supports children's ability to anticipate and react to others' social cues (Carpendale & Lewis, 2004). In the current study, the primary goal was to examine how individual differences in social anxiety are related to SIP, as previous work has not fully investigated this connection.

Previous work has identified associations between children's social temperaments and mentalizing abilities. As early as 10 months of age, infants who are higher in parent-reported

shyness/fearfulness (considered a temperamental precursor of social withdrawal and social anxiety) habituated to an experimenter's social, goal-directed behaviour more quickly relative to more outgoing infants (LaBounty et al., 2018). Beyond basic orienting to social stimuli, shyness is also positively associated with mental state reasoning. Toddlers rated as relatively high in parent-reported shyness at 18 months out-performed less-shy toddlers on a standard false belief task administered at three years of age (Mink et al., 2014). Similarly, four-year-old children who engaged in more observational, onlooking behaviours during social play with unfamiliar peers displayed greater accuracy on false belief tasks (Bartsch & Wellman, 1989; Moore et al., 2011; Wellman et al., 2001). Intriguingly, four-year-old children who demonstrated negative, maladaptive expressions of shyness (i.e., frowning, looking away) were more likely to demonstrate poorer theory of mind whereas children who demonstrated more positive, adaptive expressions of shyness (i.e., smiling, looking towards an experimenter versus avoiding them) demonstrated more sophisticated theory of mind (MacGowan et al., 2022). However, past studies have focused primarily on children's basic theory of mind understanding (i.e., that others have different mindsets and intentions) but did not investigate socially anxious children's understanding others' emotional displays and intentions. Therefore, one goal of this study was to extend these past studies to examine the associations between social anxiety and children's mentalizing about others' socio-emotional displays.

There is debate in the field whether improved mentalizing abilities about others' emotional displays are a benefit or a hindrance to the social and emotional experiences of socially withdrawn children. On one hand, it may be that having more accurate mentalizing abilities provides a scaffold for supporting competent social behaviour, through increased awareness of social information and rules. For example, children who demonstrate more accurate mental state

understanding at five years demonstrated more prosocial behaviour and experience greater peer acceptance two years later (Caputi et al., 2012). On the other hand, some children with advanced understanding of false beliefs and mixed emotions are *hyper-sensitive* to the thoughts and feelings of others. Based on their responses to hypothetical scenarios describing an interaction between a teacher and a student who made a mistake, preschoolers with advanced understanding of false belief and mixed emotions were more sensitive to teacher criticism (Cutting & Dunn, 2002). Children who scored higher on false belief measures were more reluctant to perform activities, such as singing and dancing, in front of an experimenter (Chaplin & Norton, 2015), interpreted as reflecting heightened self-consciousness and a fear of negative evaluation. Similarly, adolescents with advanced emotion recognition abilities experience greater distress following a social stress task, as measured through salivary cortisol (Bechtoldt & Schneider, 2016). Furthermore, youth who experienced more severe social anxiety have been found to struggle more with elements of social cognition (i.e., emotion understanding in others, verbal and non-verbal social communication, etc.) than their less socially anxious counterparts (Pearcey et al., 2021). In contrast, research with four-year-olds found that children with poorer mental state understanding (and particularly children that demonstrated less outgoing social gestures) were more socially anxious (Coplan et al., 1994). In adults, it is equally unclear whether social withdrawal is associated with improved or diminished mental state abilities; there are some reports that adults with clinical levels of social anxiety have more difficulty in identifying emotions, in both static and dynamic emotional displays (Hezel & McNally, 2014; Washburn et al., 2016). In contrast, other studies report that individuals high in social anxiety are more successful at identifying others' static emotions and intentions (Sutterby et al., 2012).

Beyond simple emotion identification, social anxiety in adults is associated with a pattern of over mentalizing, or excessive reasoning, in response to socially relevant stimuli, such as facial expressions or intentions communicated through speech and subtext (Hezel & McNally, 2014; Washburn et al., 2016). Over mentalization occurs when individuals excessively analyze or draw extended, elaborate interpretations of others' behaviours and emotions that go beyond the information presented (Dziobek et al., 2006). High levels of social anxiety may motivate individuals to extensively contemplate the mental reasoning processes of others, due to a fear of social evaluation, resulting in a preoccupation with the mental states of others (Washburn et al., 2016). Again, while having more awareness of social information may be beneficial in general, these findings suggest that social anxiety may lead to, or be a consequence of, attending excessively to social information. The link between over mentalizing and social anxiety, as found in adults (Hezel & McNally, 2014; Washburn et al., 2016), has yet to be examined in children. Furthermore, these associations have yet to be examined longitudinally in either adults or children, therefore it is unclear whether patterns of mentalization impact the development of social anxiety. Longitudinal work in children has found that early socially fearful temperaments are positively associated with later reasoning abilities (e.g., Mink et al., 2013) and that reasoning abilities predict later social withdrawal (Moore et al., 2011). It is for this reason that I investigated whether EI and mentalizing impacted social anxiety over the course of a year in middle childhood.

### **The Present Study**

In summary, the goal of the current study was to examine the concurrent and longitudinal relations between children's self-reported social anxiety and both EI and mentalization. I hypothesized that social anxiety would be associated with higher EI and a bias towards over



mentalizing. In addition, I examined the moderating effect of mentalizing biases on self-reported social anxiety over the course of a year, where I hypothesized that social anxiety at age 8 would be highest among children who were both high in social anxiety and demonstrated over mentalizing biases at age 7.

## Method

### Participants

Participants visited a university laboratory on two occasions (henceforth T1 and T2). At T1, participants were 91 seven-year-olds ( $M = 7.31$ ,  $SD = 0.30$ ; 50% female), of whom 81 returned one year later at T2 ( $M = 8.34$ ,  $SD = 0.30$ ; 54% female; 89% retention rate). The present study was part of a larger study examining the relations between cognition, attention, and temperament. Participants were 90% Caucasian and recruited from a suburban area in southwestern Ontario, Canada. As a proxy for socioeconomic status, parents were asked to report the highest level of education they obtained, as well as their annual household income. Thirty-seven percent of mothers had an advanced or professional degree, 34% had an undergraduate university degree, 17% had completed a college program, 9% had some university/college experience, and 3% had a high school diploma. For parental education, 37% of fathers had an advanced or professional degree, 34% had an undergraduate university degree, 17% had completed a college program, 9% had some university/college experience, and 3% had a high school diploma. Annual household income was > \$100,000/year for 57% of the sample, \$75,000–\$99,999 for 23% of the sample, \$50,000–\$74,999 for 10% of the sample, and \$25,000–\$49,999 for 8% of the sample.

At T1, 91 children completed a static EI task, one child failed to complete the social anxiety measure and two children's social anxiety data were removed due to noncompliance with

measure (i.e., failure to follow instructions). The dynamic EI task was modified after the study began due to potential ambiguity in the prompt question, resulting in missing data for the first 14 participants in the study. One child's data was excluded from the dynamic EI task due to previous knowledge of the movies used for stimuli and another child's data was excluded due to experimenter error. As a result, 73 children's data were available for analysis of dynamic EI and mentalization. At T2, 10 children did not return, one child's data was excluded due to their aging out of the study, while another's data was excluded due to noncompliance with study protocols. This resulted in a final sample of 61.

## **Procedure**

Children and their parents visited the university lab twice: at age seven and then again at age eight (T1 and T2). Parental consent and child assent were obtained before data were collected during a two-hour study visit. Each participant completed a series of self-report questionnaires and cognitive tasks, administered by a trained research assistant. The order of tasks was randomized for each participant to control for potential order and fatigue effects. All measures and procedures were approved by the Office of Research Ethics at the University of Waterloo. At T1, participants completed a self-report measure of social anxiety, as well as two EI tasks (see Measures). At T2, participants repeated the self-report measure of social anxiety.

## **Measures**

### ***Receptive Vocabulary***

Children's receptive vocabulary was assessed using the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 2007). The PPVT is commonly used and has demonstrated age-appropriate and psychometric soundness, as well as good test-retest reliability and construct validity (Gershon et al., 2014). On 25 trials, children were shown four images on a tablet screen

and then played an audio recording of a word. Participants were then asked to select the image that matched the word. The test provides standardized, age-adjusted scores with a mean score of 100.

### ***Social Anxiety***

Children's social anxiety was assessed using the 6-item social anxiety subscale of the child-reported version of the Screen for Child Anxiety Related Disorders (SCARED-C; Birmaher et al., 1996). The SCARED-C is a 41-item self-report measure that asks children about their feelings of anxiety in a variety of scenarios and circumstances. Children respond using a three-point Likert scale (0 = not true or hardly ever true, 1 = sometimes true, 2 = true or often true), with higher scores indicating greater feelings of anxiety. The SCARED-C has been found to effectively discriminate between anxiety and depression, as well as between different forms of anxiety (Birmaher et al., 1999). This measure has previously been used in non-clinical, community samples to assess trait level differences in social anxiety (Poole & Schmidt, 2021). The social anxiety subscale was used for analyses. This subscale includes six questions focusing on children's feelings of discomfort in social settings. A sample item was: "*I feel nervous when I am with other children or adults, and I have to do something while they watch me.*" Clinical cut-offs for this specific subscale have been identified as  $\geq 8$  (Ivarsson et al., 2018). For this sample, 36% of participants met or were above the clinical cut-off at age 7, while 35% met this cut-off at age 8. Internal consistency for this sample on the social anxiety subscale was  $\alpha = 0.67$  at 7 years and  $\alpha = 0.77$  at 8 years.

### ***Static Emotion Identification***

The Reading the Mind in the Eyes - Child Version was used as a static measure of EI (RME-C; Baron-Cohen et al., 1997). The task consists of 28 images of the eye region of a face

displaying different emotional states. Participants are shown four options of emotional state words per image and asked to identify what the person is feeling. The total score is the sum of the number of correct responses. The RME-C has previously been found to be a valid measure of EI that is sensitive to age-related changes and is able to differentiate between diagnostic groups known to differ in EI capabilities (i.e., autistic versus typically developing child samples; Baron-Cohen et al., 1997). Despite being widely used, the internal consistency of the RME-C ranges from low to acceptable (Rosso & Riolfo, 2020). Consistent with this, the internal consistency for the current sample was low ( $\alpha = 0.46$ ).

### ***Dynamic Emotion Identification***

The Reading the Mind in Films - Child Version (RMF-C; Golan et al., 2008) as a dynamic measure of EI. Adapted from the original (static) measure of the RME-C (Baron-Cohen et al., 1997), this task was established to assess children's ability to identify others' emotions through dynamic emotional cues. Past work demonstrates that performance on this task reliably differentiates between diagnostic groups known to differ in EI abilities (i.e., autistic versus typically developing child samples; Golan et al., 2008). Six videos were selected from a wider dataset of movie clips released in 1995 or earlier so they would be unfamiliar to children. These six videos were specifically chosen because (1) they depicted socio-emotional interactions between at least two characters in the scene and (2) they depicted emotions that were correctly identified by the majority of participants in the original neurotypical validation sample. Given the dynamic nature of the stimuli, children could use a variety of cues (e.g., vocal tone, facial expression, body language) to infer the emotion of the protagonist. Videos were 6–30 seconds in length and presented in a randomized order. For each video, participants were asked to focus on the emotional state of the protagonist and then answered two questions: 1) a multiple-choice

question: *What emotion did the protagonist display at the end of the clip?* with four options of emotional state words) and 2) an open-ended question: **Why** did the protagonist feel that way?

Participants received a score of 1 for each correctly identified emotion and a score of 0 for each incorrect response. The total summed score reflects participants' overall dynamic EI accuracy. The second question addressed participants' mentalizing about the protagonist's emotional state. Responses to the open-ended question were recorded on video for later transcription and coding. In the original study by Golan et al. (2008), participants' accuracy on the six trials ranged from 75% to 83%. In the current study, accuracy on the same six trials ranged from 43% to 82%.

**Mentalization Coding.** A primary coder (the first author) created the coding scheme and trained secondary coders for the study. Coding was conducted via Mangold's (2016) INTERACT software. The primary and a secondary coder, blinded to participants' social anxiety scores, coded the content of participants' responses to the mentalization question (see Appendix A for full coding scheme). Each response was categorized as either: 1) *Correct mentalizing*: appropriate interpretation of available information, with consideration of how situation affects emotion/thought processes; or two less accurate forms of mentalizing: 2) *Under mentalizing*: inadequate interpretation of available information, with no consideration of how situation affects emotion/thought processes; or 3) *Over mentalizing*: over interpretation of available information, with extended consideration beyond information presented of how situation affects emotion/thought processes. Over mentalizing could include consideration of imagined or expected past and future events that were not mentioned during the video stimuli (Dziobek et al., 2006). Inter-rater reliability based on 25% of cases was good, Cohen's  $\kappa = 0.75$ .

Using the transcribed responses to the mentalization question, an independent second coder counted the total number of words participants used per response. Both coders also counted the number of mental state words (e.g., want, need, feel) used in each response—words chosen based on previous work on children’s mental state language (Shatz et al., 1983). Interrater reliability for mental state word counts, assessed using intraclass correlation was 0.97, based on 25% of cases. To support the validity of the categorical coding scheme and category definitions, correct, over and under mentalizing responses were compared on (1) total frequency, (2) total number of words per response, (3) total number of mental state words per response, and (4) proportion of total mental state words to total words. See Appendix B for data visualization of comparisons.

A one-way ANOVA was conducted to compare the relative frequencies of under, correct, and over mentalizing responses. There was a significant difference in response frequencies,  $F(2,222) = 59.71, p < .001, \eta^2 = 0.54$ , with correct responses ( $M = 3.36, SD = 1.25$ ) being provided more frequently than either under ( $M = 1.76, SD = 0.22, p < .001$ ) or over ( $M = 2.27, SD = 0.22, p < .001$ ) mentalizing responses. Additionally, under mentalizing responses were provided more frequently than over mentalizing responses ( $p < .001$ ).

To further support the validity of the mentalizing coding, the total number of words and mental state words used in under, correct, and over mentalizing responses were compared using two one-way ANOVAs. Overall, total word count was significantly different between the three mentalizing response categories,  $F(2,161) = 22.42, p < .001, \eta^2 = 0.26$ . Over mentalizing responses ( $M = 31.8, SD = 1.25$ ) had, on average, more words than under mentalizing responses ( $M = 18.63, SD = 12.94, p < .001$ ) or correct responses ( $M = 38.17, SD = 17.57, p < .001$ ). Correct responses also had a greater number of words than under mentalizing responses ( $p < .001$ ).

The number of mental state words also significantly differed between the three response categories,  $F(2, 161) = 21.33, p < .001, \eta^2 = 0.28$ . A Tukey test revealed that over mentalizing responses ( $M = 1.36, SD = 1.21$ ) had a greater amount of mental state words, on average, than either under responses ( $M = 0.15, SD = 0.36, p < .001$ ) or correct responses ( $M = 1.26, SD = 1.25, p = .01$ ). Correct mentalizing responses also had more mental state words on average than under mentalizing responses ( $p < .001$ ).

In examining the rate of mental state words (relative to total word count) per response, the proportion was significantly different between the three mentalizing responses,  $F(1, 21) = 6.37, p = .02, \eta^2 = 0.31$ . A Tukey test revealed that correct and over mentalizing responses ( $M = 0.04, SD = 0.03; M = 0.04, SD = 0.03; M = 0.04, SD = 0.03$ , respectively) had a greater proportion of mental state words, on average, than under mentalizing responses ( $M = 0.01, SD = 0.04, p = .002$ ). However, correct and over mentalizing responses did not significantly differ on the ratio of mental state to total word ( $p > .05$ ). The total number of words spoken was examined in relation to self-reported social anxiety to ensure that children high in social anxiety traits did not simply talk less, in general, when responding to the open-ended mentalizing question – there were not significant associations between social anxiety and either total word or mental state word counts ( $ps > .05$ ; see Appendix B).

Bias scores were calculated by subtracting the frequency of correct responses from either over- or under-mentalizing responses. Therefore, a higher score indicated a greater number of under or over mentalizing responses relative to correct mentalizing responses. This approach was used rather than entering all three categorical variables (i.e., under, correct, and over mentalizing) into regression analyses separately as scores on any two categories fully specified the third.

## Data Analysis Plan

First, we screened the data for univariate outliers using criteria of absolute values of skew  $< 2$  and kurtosis  $< 7$  (West et al., 1995). Second, we tested for age-related changes in social anxiety from T1 to T2 using paired samples t-tests. Third, we ran a hierarchical regression analysis predicting T2 social anxiety. Independent variables were added in the following steps: (1) T1 vocabulary, sex, and age (2) T1 social anxiety, (3) T1 static EI, T1 dynamic EI, T1 over mentalizing bias, and T1 under mentalizing bias, and (4) four two-way interactions: T1 social anxiety \* T1 static EI, T1 dynamic EI, T1 over mentalizing bias, and T1 under mentalizing bias. Analyses were conducted using IBM Statistical Package for the Social Sciences (SPSS) 27 (IBM Corp, 2021).

## Results

### Descriptive Statistics and Correlations

Descriptive statistics and zero order correlations for all variables are presented in Table 1 and 2, respectively. Participants' age at T1 was correlated with T1 vocabulary and T1 social anxiety:  $r(73) = .27, p = .04, r(73) = .35, p = .005$ . This indicates that older children tended to have better vocabulary skills and to report higher levels of social anxiety at T1.

All continuous variables demonstrated good normality in their distributions, with absolute values of skew  $< 0.01$  and kurtosis  $< -1.4$  (see Appendix C for data visualization of SCARED-C scores).

Table 1

*Descriptive statistics for core study variables.*

	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
T1 vocabulary	61	113.01	11.97	91.00	140.00
T1 static EI	61	17.44	3.27	11.00	25.00
T1 dynamic EI	61	3.59	1.22	1.00	6.00



T1 under mentalizing bias	61	-1.72	2.42	-6.00	5.00
T1 over mentalizing bias	61	-0.23	2.10	-6.00	3.00
T1 social anxiety	61	6.08	3.03	0.00	14.00
T2 social anxiety	61	6.41	3.19	0.00	14.00

Table 2

<i>Zero-order correlations between core study variables.</i>									
	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. T1 vocabulary	-								
2. T1 age	.27*	-							
3. T1 sex	.19	.10	-						
4. T1 static EI	-.09	.13	.06	-					
5. T1 dynamic EI	.12	.11	.13	.14	-				
6. T1 under mentalizing bias	-.18	-.11	.11	-.12	-.12	-			
7. T1 over mentalizing bias	-.03	-.05	-.02	-.25*	-.06	.57***	-		
8. T1 social anxiety	-.08	.35**	-.18	-.03	.26*	.04	.27*	-	
9. T2 social anxiety	-.13	.21	-.22	.02	-.03	.05	.03	.41***	-

Note. \* $p < .05$ , \*\*\* $p < .001$ . Sex: 1 = female, 2 = male. EI = Emotion identification.

### Emotion Identification

At T1, performance on the static EI measure was unrelated to social anxiety,  $r(73) = -0.03$ ,  $p = .79$ . In contrast, T1 dynamic EI performance was positively associated with T1 social anxiety,  $r(73) = .26$ ,  $p = .02$ . Longitudinally, performance on the T1 static EI measure at 7 was unrelated to T2 social anxiety,  $r(61) = -.02$ ,  $p = .85$ . There was also no association between T1 dynamic EI performance and T2 social anxiety,  $r(61) = -.03$ ,  $p = .82$ .

## **Mentalization**

Self-reported social anxiety at T1 was related to a greater over mentalizing bias,  $r(73) = .27, p = .02$ , but unrelated to T1 under mentalizing biases,  $r(73) = .04, p = .71$ . T1 under mentalizing bias did not predict T2 social anxiety,  $r(61) = .05, p = .72$ . T1 over mentalizing bias also did not predict T2 social anxiety,  $r(61) = .03, p = .82$ .

Performance on the T1 static EI measure was negatively associated with T1 over mentalizing bias scores,  $r(61) = -.25, p = .03$ .

## **Age-Related Differences**

A paired-samples t-test revealed that children's mean-level of social anxiety did not increase significantly between T1 and T2,  $t(73) = .321, p = .431$ .

## **Predicting T2 Social Anxiety**

A hierarchical regression model was used to predict T2 social anxiety. Full results are presented in Table 3. In the first step, T1 vocabulary and T1 sex did not predict T2 social anxiety ( $p$ s = .12 and .48, respectively) However, T1 age did predict T2 social anxiety ( $p = .04$ ), such that children who were older at T1 demonstrated higher social anxiety at T2. In the second step, T1 social anxiety was related to T2 social anxiety ( $p = .005$ ). In the third step, there were no main effects of static or dynamic EI, or under or over mentalizing biases on T2 social anxiety ( $p$ s = .97, .70, .98., and .60, respectively). In the fourth step, as expected, the interaction between T1 social anxiety \* over mentalization was significant ( $p = .02$ ). Interestingly, but not hypothesized, the interaction between T1 social anxiety \* under mentalization also significantly predicted T2 social anxiety ( $p = .04$ ). As illustrated in Figure 3, the link between T1 and T2 social anxiety was positive and significant for those with relatively high over mentalizing biases ( $p < .001$ ), but non-significant for those with relatively low over mentalizing biases (or more correct responding;  $p =$

.51). As shown in Figure 4, the link between T1 and T2 social anxiety was also positive and significant for those with high under mentalizing biases ( $p < .001$ ), but non-significant for those with relatively low under mentalizing biases (or more correct responding;  $p = .43$ ). As such, children who were both high in social anxiety at T1 and T1 over or under mentalizing biases reported the highest social anxiety at T2.

All other two-way interactions were not significant ( $p > .11$ ).

Table 3

*Hierarchical regression analysis predicting T2 social anxiety.*

	<i>B</i>	$\beta$	<i>F</i>	<i>Adj. R</i> <sup>2</sup>
Step 1			2.73	.08*
T1 vocabulary	-.07	-.26		
T1 sex	-.92	-.15		
T1 age	3.08	.27*		
Step 2			8.60	.19**
T1 vocabulary	-.05	-.20		
T1 sex	-.50	-.08		
T1 age	1.34	.17		
T1 social anxiety	.39	.38**		
Step 3			.12	.14
T1 vocabulary	-.05	-.19		
T1 sex	-.38	-.06		
T1 age	1.16	.10		
T1 social anxiety	.43	.42**		
T1 static EI	-.004	-.004		
T1 dynamic EI	-.14	-.05		
T1 under mentalizing bias	-.005	.004		
T1 over mentalizing bias	-.12	-.08		
Step 4			4.75	.33**
T1 vocabulary	-.06	-.21		
T1 sex	-.41	-.07		
T1 age	.15	.01		
T1 social anxiety	.47	.46**		
T1 static EI	.17	.17		
T1 dynamic EI	-.13	-.05		
T1 under mentalizing bias	.09	.07		
T1 over mentalizing bias	-.21	-.14		
T1 social anxiety X T1 static EI	.06	.20		
T1 social anxiety X T1 dynamic EI	-.09	-.11		

T1 social anxiety X T1 under mentalizing bias	.16	.28*
T1 social anxiety X T1 over mentalizing bias	.21	.34*

Note. \* $p < .05$ , \*\* $p < .01$ . Sex: females = 1, males = 2. EI = Emotion identification.

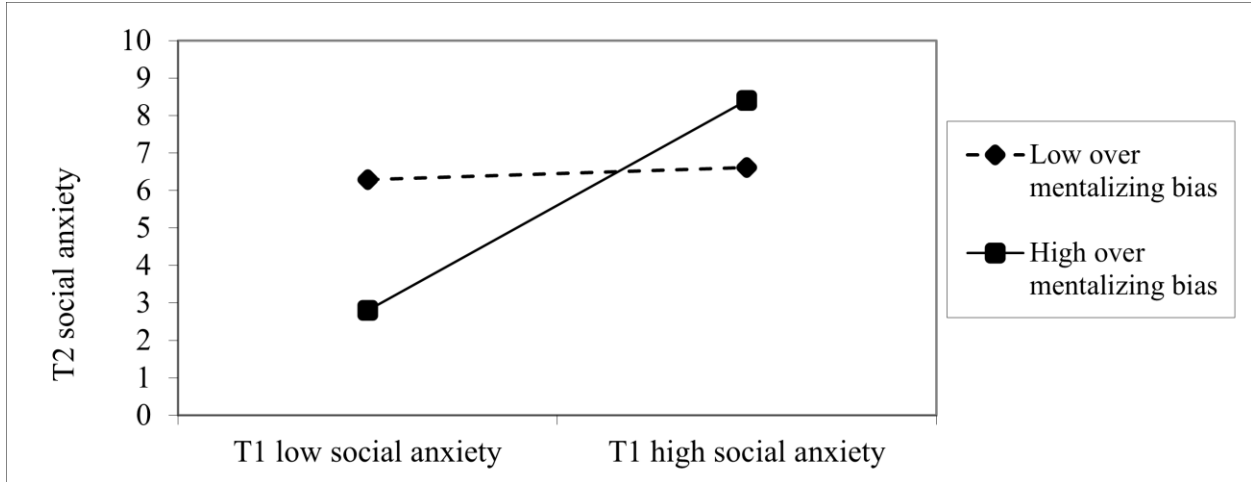


Figure 3. Effect of 7-year over mentalizing bias between 7- and 8-year social anxiety

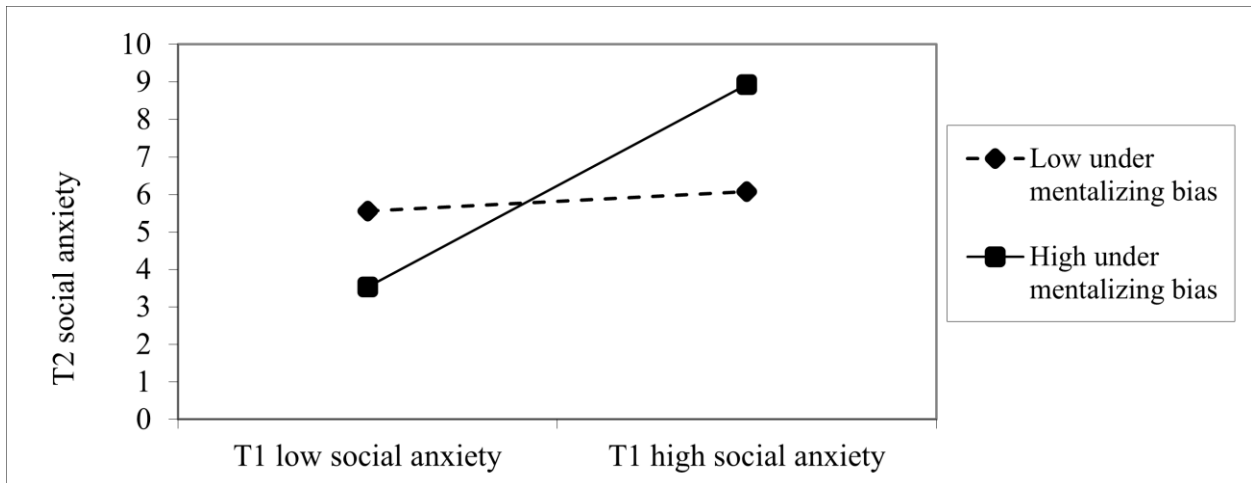


Figure 4. Effect of 7-year under mentalizing bias between 7- and 8-year social anxiety

### Discussion

Socially anxious children face a variety of social challenges which may be maintained or perpetuated by their SIP tendencies. At T1 children with high social anxiety showed improved accuracy on dynamic EI, but not static EI, and a general tendency towards over mentalizing

when reasoning about others' dynamic displays of emotion. Here, I tested whether EI and mentalizing interacted with initial levels of social anxiety to predict social anxiety one year later. It was expected that children who had high social anxiety and either an over mentalizing bias or enhanced EI at T1 would score higher on social anxiety at T2. The findings supported the first hypothesis, but not the second. Unexpectedly, the relation between T1 and T2 social anxiety was also moderated by children's T1 under mentalizing biases. That is, a tendency toward over *or* under mentalizing at age seven was associated with greater stability in self-reported social anxiety over the course of a year. Given the bias scores were computed referenced to correct responding, these findings can also be interpreted as showing that higher rates of correct mentalizing at T1 disrupted the stability of social anxiety between T1 and T2.

The current findings replicate past findings with adults showing concurrent associations between social anxiety and mentalization (Hezel & McNally, 2014; Sutterby et al., 2012; Washburn et al., 2016). Furthermore, the study extends these past studies in two critical ways. First, this is the first study to examine social anxiety traits in relation to mentalizing biases in a non-clinical, community sample of children. Second, using a short-term longitudinal design, I demonstrated the critical role of mentalizing in predicting social anxiety over the course of a year. While estimating the causes and motivations for others' emotions are critical for social (i.e., deciding how to respond) and interpersonal (i.e., accurately predicting how one is being evaluated by others) success (Washburn et al., 2016), engaging in excessive mentalizing (i.e., going beyond available information) may maintain or amplify concerns about how one is being evaluated by others that are central to social anxiety (Hezel & McNally, 2014). In this study, children high in social anxiety tended to provide excessive details and explanations for others' emotions. Their interpretation went beyond a simple cause and effect explanation that would

typically suffice to explain the emotion of another individual. While my hypotheses were grounded in understanding high levels of social anxiety, it is interesting to note that children who reported *low* social anxiety at age seven and over mentalizing tendencies showed the lowest levels of social anxiety at age eight. It could be hypothesized that for more outgoing children (i.e., children low in self-reported social anxiety), engaging in extended thinking about others' emotions is an adaptive practice. Future studies should follow these findings by studying over mentalizing in relation to a wider range of child individual differences in (a) social motivations (i.e., not only a lack of social anxiety but social exuberance, or surgency) and (b) socio-emotional functioning (i.e., not only social anxiety but self-esteem and social competence).

Children who engaged in more correct mentalizing (i.e., a low under or over mentalizing bias) showed less stability in social anxiety over the course of a year. These results demonstrate that there may be an adaptive, protective effect of reasoning about social information in terms of simple 'cause and effect' associations (correct response). Intriguingly, tending towards *either* more under mentalizing or over mentalizing response biases maintained the developmental trajectory of social anxiety. Over mentalizing tendencies were hypothesized to influence social anxiety, but under mentalizing tendencies were not. This finding may reflect the heterogeneity in the pathways and mechanisms leading to social anxiety in middle childhood (i.e., temperamental pathways versus social-experiential pathways). Specifically, the tendency to under mentalize, or miss cues, for emotional displays may negatively impact the quality of social interactions as an individual might miss the reason behind others' actions and be unable to appropriately respond and adapt their own behaviour to others (Hezel & McNally, 2014). Such an interpretation is consistent with findings showing that children who demonstrate a poorer understanding of others' mental states tend to experience greater feelings of social anxiety (Colonnesi et al.,

2017). These individuals may struggle in social settings as they make social errors due to their inability to identify and understand the social cues around them (Mazza et al., 2017). In the current sample, children who tend to under mentalize may be less successful in their peer interactions and in turn become more anxious about future social interactions (e.g., Poole et al., *in press*). In contrast, correct mentalizing may allow children to manage dynamic social interactions more successfully due to a lack of preoccupation with others' social and emotional cues, allowing for more fluid and reciprocal interactions. As compared to the tendency to over or under mentalizing, correct mentalizing may represent a 'just right' scenario for social information processing (see Chapter 5 for further discussion). The ability to dynamically adjust one's own behaviour in response to another may make a child a better social partner. In future work, it will be interesting to investigate the developmental interplay between children's daily experiences with peers (e.g., social acceptance, bullying, rejection), their mentalizing abilities, and social anxiety. It is also possible that over mentalizing results from having difficulty identifying others' emotional cues, as evidenced by the finding that children who showed poorer static EI were more likely to demonstrate over mentalizing tendencies following the dynamic task. If children struggle to identify others' emotions, they may need to work particularly hard to generate explanation for others' social behaviours.

However, the current study does not support this interpretation for socially anxious children in particular: children high in social anxiety were *more* accurate in identifying others' dynamic emotional displays and did not demonstrate either better or poorer accuracy in identifying static emotional displays. In the previous literature, there are conflicting findings on the association between social anxiety and simple EI. Work by Hezel and McNally (2014) and Washburn and colleagues (2016) found that socially anxious adults were less accurate in

identifying static emotional displays in the RME task. However, work by Sutterby et al. (2012) found that socially anxious adults were more accurate in identifying static emotion displays. In the current study, there was no relation between social anxiety and EI from static stimuli. The finding of specificity to dynamic information is of particular interest, as social anxiety has been shown to specifically impact children's behaviours during social interactions. Beginning early in childhood, children with socially fearful temperaments (e.g., high in behavioural inhibition, a developmental precursor to social anxiety) display watchful, hyper-vigilant behaviours during social interactions with unfamiliar adults and peers (Coplan & Armer, 2007). As such, many children who report high levels of social anxiety have a history of hypervigilance, carefully attending to the social cues of others to help guide their own social behaviours. In this way, children are relying upon their default SIP database, fixating upon the information that they feel is the most relevant (Verhoef et al., 2021).

The results of this study demonstrated that the relation between social anxiety and accuracy is specific to dynamic emotion displays. While this could simply reflect differences in the sensitivity of the static and dynamic EI tasks to individual differences, it could also reflect the fact that socially anxious children's vigilance is specific to novel contexts which are inherently dynamic. Therefore, they may develop specific expertise in interpreting dynamic emotional displays. The results of this study can be mapped back on to the SIP model originally put forward by Crick and Dodge (1994). This model provides a framework of how individuals process information in a social scenario and, in turn, how this processing influences their behaviour in response to the social information they receive from the outside world. This model is dynamic and continuous, reflecting the real-world nature of social interactions, as each new piece of social information begins the cycle again. Each stage of processing impacts the next



stage; the first stage being encoding of cues and the second being interpretation of cues (Crick & Dodge, 1994). The results of the current study demonstrate an association between self-reported social anxiety and both identification and interpretation of social cues. Of interest is whether social anxiety will affect not only in the moment identification and interpretation, but also socially anxious children's interpretation expectations when anticipating future social interactions. Furthermore, it is necessary to investigate how socially anxious children's actual real-world behaviour is affected by these early stages of SIP (see Chapters Three and Four).

One limitation of this study is that the role of emotional valence is not accounted for in either the static or dynamic tasks. For example, I did not consider whether the static EI image or the dynamic EI protagonist in the stimuli was demonstrating a negative or positive emotion. This does not allow for the assessment of whether social anxiety is specifically associated with advanced (or diminished) identification and reasoning about positive, negative, or both types of emotional displays. A second limitation is that the stimuli were presented using structured, in-lab tasks. Therefore, there may be differences between in-lab EI and mentalizing abilities and those found in the real-world. Socially anxious children may show even greater differentiation from less socially anxious children, when faced with real-world social stressors as they try to identify and mentalize about the emotional displays of others. A third limitation are the two EI tasks chosen. For the RME-C, the original study reported good psychometrics properties in a child sample, but other research has reported suboptimal psychometrics on the task suggesting that it may not be a sensitive measure of emotion recognition abilities in typically developing youth (Carey & Cassels, 2013). Consistent with past studies, in the current sample the internal consistency was only  $\alpha = 0.46$ . Some have suggested that the RME-C may be too simple, leading to ceiling effects and limited variability in performance (Cassels & Birch, 2014). However, in the

current sample, the mean was 17.44 from a potential score of 28, similar to the performance found in the original study by Baron-Cohen et al. (1997). Additionally, participants in the current study demonstrated poor accuracy on the RMF-C, when compared to performance in the original study by Golan et al. (2008). This may be an age effect, as the mean age of the original study was 10.1 years for the typically developing children, and the current study had a mean age of approximately seven. Therefore, it is difficult to draw conclusions about the EI performance in children due to the questionable reliability of the EI measures in the current study. Future work should investigate EI using a variety of EI measures, such as assessing EI via video stimuli or during in vivo social interactions to further investigate associations with social anxiety in children.

Finally, in this study it is unclear what the specific mechanism is that links mentalizing to changes in anxiety over time. One potential area for future study is to examine specific cognitive states that might bridge mentalizing and anxiety. For example, it is possible that over mentalizing leads to states of self-focused attention and/or rumination, factors that are known to be related to social anxiety (e.g., Poole & Henderson, *submitted*). This study was also performed in a relatively small community sample of children. Therefore, it is not known whether these results would generalize to children with clinically significant levels of social anxiety who might be expected to display even more strongly biased styles of mentalizing. Another important future direction will be to study relations between social anxiety, SIP, and children's behaviour during real-world social interactions (see Chapter Four). This will allow for the assessment of the remaining portions of the Crick and Dodge (1994) SIP model wherein children enact a behavioural response following their own identification and interpretation of the social cues put forward by others.

In conclusion, this study examined children's social anxiety over the course of a year in middle childhood and specifically examined the moderating effect of mentalizing tendencies. The findings revealed that children who reported high social anxiety, and displayed either high over and under mentalizing biases reported the highest levels of social anxiety a year later. These findings emphasize the importance of considering social-cognitive mechanisms that maintain or amplify social anxiety tendencies over time. In doing so, it also highlights opportunities for intervening in shaping children's social cognitions, which may be especially important in middle childhood, a period of increased social awareness and preoccupation for children.

### **Chapter Three: The associations between childhood social anxiety, expectations of negative evaluation, and later self-esteem.**

Portions of these data were previously presented:

Green, E.S. & Henderson, H.A. (May, 2019). *Social withdrawal and social evaluative biases: Links to emotional well-being*. Poster session presented at the 2019 Association for Psychological Science Convention, Washington, D.C.

Social anxiety is typically considered maladaptive especially given its broader long-term impacts on various aspects of social-emotional functioning including self-esteem (Gómez-Ortiz et al., 2018). . Every day, individuals use the cues and reactions of others to refine their own sense of self by reasoning, or mentalizing, about the information that they receive from their social surroundings. This mentalizing is subjective and shaped via individuals' unique experiential social history (Crick & Dodge, 1994). In my research, I am particularly interested in how children's expectations of others' evaluations affect their own sense of self and resultant self-esteem, especially in socially anxious children who may already approach their social worlds cautiously. In the current study, I examined the short-term longitudinal associations between self-reported social anxiety and self-esteem, and the potential mediating role of complex mentalizing, specifically children's expectations regarding others' social evaluations. Using the same sample of children from Chapter Two, the study followed children from ages seven to eight, a developmental period characterized by heightened sensitivity to others' social feedback (Harter, 2006).

Social anxiety varies along a broad continuum among children and adults in the general population. Social anxiety is characterized by a discomfort or fear of social settings, resulting in

behavioural withdrawal and a fear of negative evaluations from others (American Psychiatric Association, 2013). Even young children recognize social withdrawal in their peers, noticing when other children do not talk, do not make eye contact, and/or have difficulty expressing themselves verbally (Younger et al., 2008). These social behaviours are not only visible to peers, but they are generally negatively evaluated by peers as well. For example, children with poor social skills are at higher risk of victimization from peers (Fox & Boulton, 2005), and have more difficulty forming successful friendships (Greco & Morris, 2005). Over time, the predisposition towards social anxiety coupled with negative social feedback from peers can place children at a higher risk for a host of poor developmental outcomes, including more negative self-esteem.

Self-esteem is defined as an individual's sense of worth and success (Harter, 2012). High self-esteem is associated with positive outcomes throughout the life course including more success in work and relationships and greater life satisfaction in adults (Caputi et al., 2012). Children with lower self-esteem tend to be less accepted by their peers and establish fewer and lower quality friendships than their peers (Antonopoulou et al., 2019). Over time, children with lower self-esteem are more likely to experience higher rates of depression in adulthood (Steiger et al., 2014). The essential role of others' perceived or actual feedback in shaping self-esteem has long been recognized (i.e., 'looking glass self'; Cooley, 1902). In youth, self-esteem is strongly influenced by the feedback they receive from peers (Harter, 2006), with negative feedback, whether actual or perceived, being especially devastating (Miers et al., 2009). Cooley (1902) proposed that individuals create an image of themselves, and affectively evaluate this image, based on their interpretation of the feedback they receive from others during their day-to-day interactions. At approximately eight years of age, children can discriminate between their own unique areas of strength and weakness (Harter, 2006), describing themselves in both

positive or negative terms. Prior to middle childhood, while children can identify if they do good or bad things, they are not capable of expressing an overall, self-reflective self-concept (Harter, 2006).

Children high in social anxiety tend to report lower concurrent self-esteem: both within specific domains such as academic ability, athletic ability, physical appearance, and social skills (Crozier, 1995; Miers et al., 2011) and in general (Bowles, 2017; Gómez-Ortiz et al., 2018). Adolescents with a history of peer rejection and lack of friendships report both lower global self-esteem and higher social anxiety (Bosacki et al., 2008). Socially anxious children are particularly sensitive to peer feedback, with this feedback impacting socially anxious children's self-esteem to a greater extent than in non-socially anxious children. Specifically, when feedback from a hypothetical peer is positive, children high in social anxiety demonstrate greater increases in self-esteem than less socially anxious children (Reijntjes et al., 2011). The opposite effect is also true: when faced with hypothetical negative feedback, children high in social anxiety traits experience a greater decrease in self-esteem (Reijntjes et al., 2011). This suggests that feedback from peers, whether perceived or real, may be particularly important for shaping self-esteem in socially anxious children. Therefore, it is crucial to investigate the inter-relationships between social anxiety, perceptions of others' feedback, and self-esteem.

Biases in SIP, and in particular, children's expectations of others' evaluations may be an important mechanism linking social anxiety and self-esteem. Cognitive biases are unique ways, or the specific lenses through which, individuals perceive and understand social information (Platt et al., 2016). Socially anxious children and adolescents are more likely to hold negative cognitive biases that highlight and disproportionately emphasize negative feedback (Vassilopoulos & Banerjee, 2012; Weems et al., 2001). Socially anxious children are also more likely to extend

that feedback to all future social contexts, expecting more negative evaluations in their future interactions (Weems et al., 2001). Socially anxious children may be at a greater risk for negative perceptions from peers. Specifically, socially anxious children are viewed as disinterested or unwilling to interact, making them undesirable social partners (Coplan et al., 2004). Adults also have negative impressions of children who display withdrawn behaviours, with elementary school teachers and counsellors believing these more fearful children are less intelligent and less likely to achieve academic success (Nadiv & Ricon, 2020). Socially anxious children may be aware of these evaluations by others, as children are able to pick up even subtle cues about how others are evaluating them in a social setting (Malloy et al., 2016). Taking these cues and past experiences of negative evaluations into consideration, socially anxious children may come to anticipate similar reactions and evaluations from others in the future. They may come to particularly expect negative evaluations from others, and, over time, these negative expectations may impact a child's self-esteem.

### **The Current Study**

The goal of this study is to investigate the association between self-reported social anxiety at age seven and self-esteem at age eight. Of primary interest is whether children's expectations of others' social judgments mediate the association between social anxiety and self-esteem. I hypothesized that higher self-reported social anxiety at seven would be associated with lower self-esteem at eight and that this association will be partially mediated by children's expectations regarding others' evaluations.

## Method

### Participants

Participants visited a university research laboratory on two occasions (henceforth T1 and T2). At T1, participants were 91 seven-year-olds ( $M = 7.31$ ,  $SD = 0.30$ ; 50.5% female). At T2, 81 children returned at age 8 ( $M = 8.35$ ,  $SD = 0.30$ , 56% female, 89% retention rate). This is the same study sample as in Chapter Two. Participants were 90% Caucasian and recruited from a suburban Canadian area. As a proxy for socioeconomic status, parents were asked to report the highest level of education they obtained, as well as their annual household income. Thirty-seven percent of mothers had an advanced or professional degree, 34% had an undergraduate university degree, 17% had completed a college program, 9% had some university/college experience, and 3% had a high school diploma. For parental education, 37% of fathers had an advanced or professional degree, 34% had an undergraduate university degree, 17% had completed a college program, 9% had some university/college experience, and 3% had a high school diploma. Annual household income was  $> \$100,000$ /year for 57% of the sample, 23% earned between  $\$75,000$ – $\$99,999$ , 10% earned between  $\$50,000$ – $\$74,999$ , and 8% earned between  $\$25,000$ – $\$49,999$ .

At T1, 88 participants provided self-reported social anxiety data: one child failed to complete the social anxiety measure and two children's social anxiety data were removed due to noncompliance (i.e., failure to follow instructions). Ten children did not return for the T2 visit. Of those who participated at T2, one child's data was excluded due to the fact they were over 9 years of age when they came for their T2 visit, two children did not complete the self-esteem measure, one child did not complete the Mentalizing task, while another child's data was



excluded due to noncompliance with study protocols. This resulted in a final sample of 75 participants with data from T1 and T2.

## **Procedure**

Children and their parents visited the university lab twice: at age seven and then again at age eight (T1 and T2). Parental consent and child assent were obtained before data were collected during a two-hour study visit. Each participant completed a series of self-report questionnaires and cognitive tasks, administered by a trained research assistant. The order of tasks was randomized for each participant to control for potential order and fatigue effects. All measures and procedures were approved by the Office of Research Ethics at the University of Waterloo. At T1, participants completed a self-report measure of social anxiety. At T2, participants repeated the self-report measure of social anxiety as well as a self-report measure of self-esteem, and an assessment of mentalizing (see Measures).

## **Measures**

### *Social Anxiety*

The Screen for Child Anxiety Related Disorders – Child report (SCARED-C; Birmaher et al., 1999) was used to assess children’s social anxiety. The SCARED-C is a 41-item self-report measure that asks children about their feelings of anxiety in a variety of scenarios and circumstances. Children respond using a three-point Likert scale (0 = not true or hardly ever true, 1 = sometimes true, 2 = true or often true), with higher scores indicating greater feelings of anxiety. The SCARED-C has been found to effectively discriminate between anxiety and depression, as well as between different forms of anxiety (Birmaher et al., 1999). This measure has previously been used in non-clinical, community samples to assess trait level differences in

social anxiety (Poole & Schmidt, 2021). The social anxiety subscale was used for analyses. This subscale includes six questions focusing on children's feelings of discomfort in social settings (e.g., *I feel nervous when I am with other children or adults, and I have to do something while they watch me*). Clinical cut-offs for this specific subscale have been identified as  $\geq 8$  (Ivarsson et al., 2018). For this sample, 39% of participants met or were above the clinical cut-off at age 7, while 34% met this cut-off at age 8. Internal consistency for this sample on social anxiety subscale was  $\alpha = 0.67$  at 7 years and at 8 years,  $\alpha = 0.77$ .

### ***Self-Esteem***

To assess children's self-esteem, I used the Self-Perception Profile for Children (SPPC; Harter, 1982). The SPPC is a self-report measure with 36 items used to evaluate children's perception of their own competence across a series of domains: scholastic competence; social competence; athletic competence; physical appearance; behavioural conduct; and global self-worth. For the purpose of this study, the six-item global self-worth scale was used to index children's global self-esteem. An example item is "*Some kids are often unhappy with themselves BUT Other kids are pretty pleased with themselves*". Children answer each question by deciding between which of two hypothetical other children is most similar to themselves and then deciding whether the description of the chosen hypothetical child is 'Really True for Me' or 'Sort of True for Me'. This provides scoring of one through four. This measure is for children aged 8 through 11 and has been found to have good internal consistency (Harter, 2007). Internal consistency for this sample for the global self-worth scale was  $\alpha = 0.80$ .

### ***Expectations of Others' Evaluations***

The Mentalizing Task designed by Sharp et al. (2007) was used to assess children's expectations of others' evaluations. The Mentalizing Task consists of 15 peer-related social scenarios, designed to measure biases in children's mentalizing about others' perceptions of them. This task has male and female versions and has previously been used in 7- to 11-year-olds (Sharp et al., 2007). Each story presents a potentially stressful scenario where children are prompted to imagine what others would think of them, should they be the protagonist in the story. Each story is accompanied by a cartoon image of the scenario and a multiple-choice option, with three potential responses: overly positive, neutral, and overly negative. An example of a scenario is: "*One day, Sally/Paul was playing by herself while all her classmates were playing football together.*" After listening to the scenario, children were asked "*Imagine you were Sally/Paul. If you were, what do you think the other kids would be thinking about you?*" and presented with three response options: a) *Positive* – They would think I'm cool and funny, b) *Neutral* – They would think I'm just doing my own thing, and c) *Negative* – They would think I have no friends. This task has previously been found to demonstrate good reliability via a latent-class model analysis, demonstrating that the three response options loaded onto separate underlying classes of participants (Sharp et al., 2007). The three classes differentiated children's response styles and associated socio-emotional wellbeing (e.g., Sharp et al., 2007). The internal consistency for the current sample was  $\alpha = 0.78$ .

Children's total responses are summed to determine the amount of positive, neutral, or negative responses overall (see Appendix D for descriptive data of measure). In order to assess participants' positive and negative biases in response to the evaluative social scenarios, difference scores were created by subtracting the frequency of neutral responses from the

frequency of either negative or positive selections, respectively. These scores are referred to as ‘negative evaluation bias’ and ‘positive evaluation bias’ with higher scores indicating a greater number of negative or positive selections, respectively, and lower scores reflecting more neutral selections.

### **Data Analysis Plan**

Data were examined for univariate outliers using criteria of absolute values of skew  $< 2$  and kurtosis  $< 7$  (West et al., 1995). Zero-order correlations were conducted to examine associations between all study variables, while a mediated regression analysis was conducted to identify the longitudinal associations between variables. This mediation analysis was run with T1 social anxiety as the predictor variable and T2 self-esteem as the outcome variable, with T2 expectations of others’ evaluations biases acting as a mediator. Of interest to this study was the role of negative evaluation biases in mediating the relation between earlier social anxiety and later self-esteem. Positive evaluation biases were assessed in a separate regression model to test the specificity of associations to negative evaluation biases.

Analyses were conducted using IBM Statistical Package for the Social Sciences (SPSS) 27 (IBM Corp, 2021). Mediation analyses were conducted with the add-on PROCESS package for SPSS (Hayes, 2022).

## **Results**

### **Descriptive Analyses and Correlations**

Table 4 contains descriptive data (*M*, *SD*) on all study variables at T1 and T2, while Table 5 contains zero-order correlations between all study variables at T1 and T2.

Table 4

*Descriptive statistics for core study variables.*

	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
T1 social anxiety	88	6.03	3.13	0.00	14.00
T2 self-esteem	75	20.31	3.41	8.00	24.00
T2 negative evaluation bias	75	-4.25	5.24	-12.00	12.00
T2 positive evaluation bias	75	-2.04	4.73	-10.00	10.00

Table 5

*Zero-order correlations between core study variables.*

	1.	2.	3.	4.	5.	6.
1. Sex	-					
2. T1 age	.07	-				
3. T1 social anxiety	-.15	.24*	-			
4. T2 self-esteem	-.10	-.21	-.30**	-		
5. T2 negative evaluation bias	.07	.08	.26*	-.36**	-	
6. T2 positive evaluation bias	.01	-.14	.09	-.12	.48***	-

*Note.* \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Sex: 1 = female, 2 = male.

Preliminary correlation analyses revealed that children's self-reported social anxiety at T1 was negatively associated with self-reported self-esteem at T2. In addition, T1 social anxiety was positively associated with T2 negative evaluation bias, such that higher social anxiety at T1 predicted more negative (vs. neutral) selections on the Mentalizing Task at T2. Children's T2 negative evaluation biases were negatively associated with T2 self-esteem such that children who selected more negative (vs. neutral) options on the Mentalizing task reported lower self-esteem. T1 social anxiety and T2 positive evaluation bias scores were unrelated, as were T2 positive evaluation bias scores and T2 self-esteem.

## Mediation Analyses

In order to test the central hypothesis of the study, children's expectations of others' evaluations were investigated as a mediator of the association between T1 social anxiety and T2 self-esteem, using PROCESS, model 4 for mediation (Hayes, 2022). A mediation analysis was conducted with T1 social anxiety as the predictor variable and T2 self-esteem as the outcome variable, and T2 negative evaluation bias as the mediator variable. T1 age was controlled for in this model. As there was no connection between T1 social anxiety and T2 positive evaluation bias, or T2 positive evaluation bias and T2 self-esteem, a second mediation model was not tested.

The total effect of T1 social anxiety to T2 self-esteem was significant  $c = -.36$ ,  $SE = .13$ ,  $t(75) = -2.88$ ,  $p = .005$  and was comprised of both a significant direct effect of T1 social anxiety on T2 self-esteem,  $c' = -.27$ ,  $SE = .13$ ,  $t(75) = -2.17$ , 95% CI  $[-.52, -.02]$ ,  $p = .03$  and a significant indirect effect of T1 social anxiety on T2 self-esteem, via T2 negative evaluation bias  $ab = -.09$ ,  $SE = .06$ , 95% CI  $[-.24, -.002]$ . This indicates a partial mediation between T1 social anxiety and T2 self-esteem, such that greater T1 social anxiety was predictive of poorer T2 self-esteem both directly and indirectly via T2 negative evaluation bias.

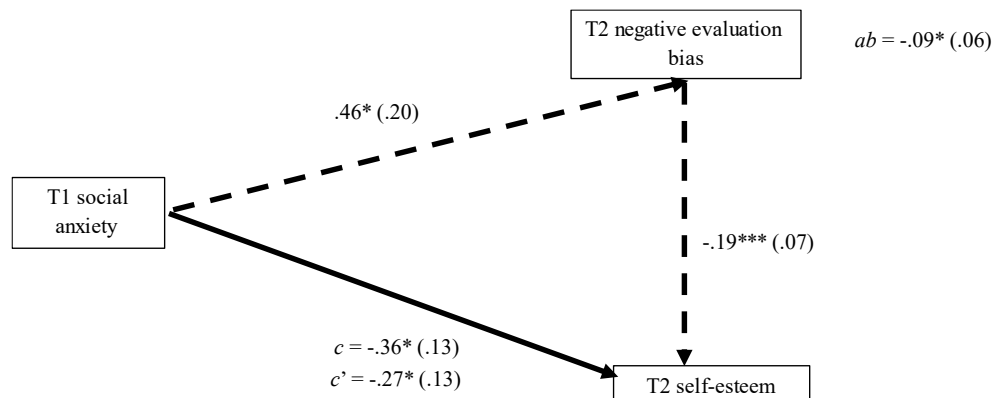


Figure 5. Mediation model demonstrating the total effect of T1 social anxiety on T2 self-esteem ( $c$ ; controlling for T1 age), as well as the direct effect ( $c'$ ) of T1 social anxiety to T2 self-esteem, controlling for the indirect effect of T2 negative evaluation bias ( $ab$ ). Associations between T1 social anxiety and T2 negative evaluation bias ( $a$ ) and T2 negative evaluation bias and T2 self-esteem ( $b$ ) are also shown. Standard errors shown in parentheses.

## Discussion

In the current study, I investigated the role of children's expectations of others' evaluations in linking individual differences in social anxiety and later self-esteem. Consistent with my primary hypothesis, I found that children high in self-reported social anxiety at seven years reported lower self-esteem a year later and that this association was partially mediated via children's negative expectations of others' evaluations in a social setting. These results illustrate the critical role of social information processing biases in linking early social anxiety to later socio-emotional outcomes.

Social anxiety at age seven was directly and negatively associated with self-reported self-esteem at age eight. This replicates earlier literature investigating the link between childhood social anxiety and self-esteem: children and adolescents with both high levels of trait anxiety and clinical levels of social anxiety have previously been found to report lower concurrent levels of self-esteem (Bowles, 2017; Gómez-Ortiz et al., 2018). The current study extended this past work by investigating social information processing biases as a potential mechanism linking the two constructs. Previous literature has found that children high in social anxiety tend to hold more negative perceptions of themselves, specifically in social settings (Miers et al., 2011) and in general (Rudy et al., 2012). Socially anxious children report more negative self-perceptions following social performance tasks (i.e., public speaking), perhaps due to their expectations that others' will also perceive them negatively (Halldorsson et al., 2019). Developmentally, children's negative self-perceptions (i.e., domain-specific and global self-evaluations) have also been found to increase shy children's risk of developing clinical levels of social anxiety (Blöte et al., 2019). Over time, socially anxious children's negative perceptions of themselves may be integrated into their SIP database affecting their expectations for how others will perceive them as well. A history of negative reactions from others may contribute to the development of socially anxious children's biased expectations over time. Children who experience social anxiety are often confronted with negative reactions from peers (Miers et al., 2011), teachers (Coplan et al., 2011), and parents (Bögels & Brechman-Toussaint, 2006). Negative reactions may be elicited in others by socially anxious children's reticent behaviours including their general watchfulness, vigilance, and lack of enthusiasm in social settings (Coplan et al., 2004; Rimm-Kaufman & Kagan, 2005). Perhaps these observable patterns of behaviour lead peers to think that socially anxious children have poorer social skills and to consider them less probable



future friends (Miers et al., 2010), which in turn reduces the likelihood that peers will initiate social exchanges with socially anxious children (Miers et al., 2011). My findings suggest that over time these social experiences may be internalized by children high in social anxiety and shape their expectations regarding future social interactions. Following the logic that actual experiences shape future expectations, the term biased may not be appropriate when describing socially anxious children's expectations regarding others' future evaluations. Future work should investigate the longitudinal associations between socially anxious children's negative evaluation expectations and the actual impressions they leave on their peers in real-world social behaviour, to directly assess whether their expectations are accurate as opposed to biased. Via longitudinal work and dyadic research, it would be interesting to examine the relations between socially anxious children's expectations about how others will evaluate them and their peers' actual evaluations following a dyadic interaction. Extending such a design over time, would allow for direct tests of directionality between children's real-world social behaviours and the accuracy of their expectations (see Chapter Five for further discussion).

The specificity of associations to negative evaluation biases, but not positive evaluation biases, is particularly interesting. Although both bias scores included neutral responses, self-reported social anxiety was specifically associated with negative expectation bias scores. Although positive biases, at face value, sound beneficial (i.e., optimistic when no other information is available to suggest otherwise), past research shows that positive biases can also pose a risk for socio-emotional functioning. Using the same task as the current study, Sharp et al. (2007) reported that positive expectation biases were associated with increased externalizing psychopathology. Externalizing disorders could be considered in many ways, as polar opposite to social anxiety, with a drive towards impulsivity and seeking attention from others, whether that

attention is positive or negative (Samek & Hicks, 2014), something that children high in social anxiety actively try to avoid (Rimm-Kaufman & Kagan, 2005). In considering the role of positivity and negativity, children's neutral response selection must also be considered: overall, the most common response children selected when asked what other children might think of them in potentially stressful social situations, was neutral (e.g., being chosen first to read a poem in front of the class and selecting the neutral response "*They would think it could have been anyone who went first*" versus the positive "*They would think I have a really good poem*" or negative "*They would think I'll do really badly*"; Sharp et al., 2007). When considering how the bias scores were computed, the relation between social anxiety and evaluation expectations also means that children low in social anxiety selected more neutral than negative responses to the vignettes. The same can be said for children who reported relatively high self-esteem, as they were also more likely to select neutral versus negative responses. Therefore, it appears that maintaining neutral expectations of others' evaluations, in the absence of any additional information about the person or the context, is an adaptive strategy. While the popular press often sends messages to both children and adults to 'just think positively' (Coelho et al., 2015), it may in fact be more adaptive to 'just think neutrally' in the absence of any additional information, or to find a 'happy medium' (see Chapter Five for further discussion). Consistent with this interpretation, in an intervention with socially anxious 10–11-year-olds, children were taught to view social scenarios as benign/neutral versus negative (Vassilopoulos et al., 2009) and, over time, these children experienced lower social anxiety symptoms and less pre-emptive anxiety when imagining future social scenarios. On an encouraging note, self-esteem is also flexible and can be guided towards a more confident perspective (Steiger et al., 2014). Therefore, the findings of the current study suggest that targeting children's expectation biases may not only

be an effective strategy for reducing social anxiety, but it may also in turn function to increase self-esteem in socially anxious children.

A limitation of the current study is that neither self-esteem nor negative expectations of evaluations were assessed at T1, so it is not possible to disentangle the directions of effects. It may be that children's earlier self-esteem could act as a protective factor at T1, making it less likely for children to demonstrate negative evaluation biases at T2 and supporting stronger self-esteem at T2. Future work should extend these findings by assessing children's mentalizing about real-world social partners' evaluations (i.e., meta-perceptions) in relation to the partners' actual evaluations (i.e., perceptions). Such a study could address two critical questions: 1) do children's pre-existing expectations of general evaluations from others based on hypothetical scenarios match their sense of evaluations following a real social interaction and 2) do these hypothetical and real-world expectations correspond to their social partner's actual evaluations/perceptions, or are they negatively biased? Concurrently, school-aged children have been found to demonstrate short-term, poor social skills following a negative peer experience that also negatively impacted child's self-reported self-esteem (Lehman & Repetti, 2007). It would be interesting to examine whether the magnitude and duration of these effects are influenced by trait social anxiety. Previous work has found that socially anxious children tend to experience great variability in their self-esteem, following feedback from a hypothetical peer, with positive feedback leading to very high self-esteem and negative feedback leading to very low self-esteem (Reijntjes et al., 2011). However, the results found by Reijntjes et al., (2011) were based on data collected immediately post-task. Future work should investigate whether socially anxious children's experiences of actual peer feedback are maintained within their SIP database, potentially affecting their long-term socio-emotional functioning. One way to assess

this would be via longitudinal follow-up of participants. It may be that children with high levels of social anxiety will better remember negative feedback and demonstrate increasingly poorer self-esteem and greater negative evaluation expectation biases across time.

Social anxiety is not simply an in-the-moment experience for children that passes once the child leaves a stressful social interaction. As demonstrated in this study, socially anxious children demonstrate unique cognitive representations of social information (path A, Figure 1), even when not engaged in a social interaction, specifically in how they expect others to evaluate them. Furthermore, the effect of socially anxious children's mentalizing was found to increase the likelihood of poorer socio-emotional functioning as measured by the children's self-esteem (path B, Figure 1). This is crucial as the findings of this study suggest that socially anxious children's negative expectations tend to increase the risk of negative self-perception, predicting likely poor long-term outcomes for socially anxious children. By taking into consideration socially anxious children's internal cognitive experience, it may be possible to understand socially anxious children's unique stressors and guide them towards a more positive and adaptive outcome.

## **Chapter Four: Social information processing and children's observed social behaviours in a dyadic interaction.**

Portions of these data were previously presented:

Green, E.S., Labahn, C., & Henderson, H.A. (April, 2021). *What are you thinking? The role of mentalization in children's dyadic interactions with unfamiliar peers*. Poster presented at the 2021 Society for Research in Child Development Meeting, Virtual Meeting.

In social interactions, socially anxious children display behaviours that communicate their discomfort. Socially anxious children tend to be identified as withdrawn, reticent, and poor social partners by their peers (Coplan et al., 2004; Younger et al., 2008). However, these observable behaviours are only a portion of the experience of a socially anxious child and do not on their own provide information about the accompanying thoughts, feelings, and motivations. In Chapters Two and Three, children's self-reported social anxiety was related to how they reasoned, or mentalized, about social information in relation to others' emotional displays (Chapter Two) and peers' perceptions of themselves in hypothetical social situation (Chapter Three). An important next step is to extend these studies to examine the relations between social anxiety, mentalizing styles, and children's real-world social behaviour. To understand these associations, it is critical to capture the interpersonal dynamics underlying social experiences by examining how social anxiety and mentalizing are related to not only a child's own social behaviour but their social partner's as well (see paths C and D in Figure 1). Therefore, the goal of the final study included in my dissertation was to a) investigate the associations between children's self-reported social anxiety and their own, and an unfamiliar peer's, observed social engagement, and b) examine the potential mediating role of mentalizing in these associations.

Social anxiety is characterized by a pre-emptive and persistent fear of negative evaluation in social interactions (American Psychiatric Association, 2013). For many children, the development of social anxiety can be traced along a developmental trajectory: in infancy,

fearfulness and withdrawal are expressed in response to novelty (e.g., retreating from novel contexts and individuals; Fox et al., 2005). By middle childhood, these fearful and withdrawn behaviours become internalized and include feelings of self-consciousness in novel social situations where there is the potential to be evaluated by others self-conscious shyness that involves the child's cognitive and emotional tendencies (Coplan et al., 2004; Crozier, 1995). At the behavioural level, socially anxious children physically withdraw from interactions with others while remaining watchful and vigilant (Rimm-Kaufman & Kagan, 2005). This behaviour is interpreted as reflecting an internal approach-withdrawal motivational conflict; that is, socially anxious children want to engage with others but pull away due to a fear of negative evaluations and exclusion (Coplan et al., 2004). While not immediately visible to outside observers, it is hypothesized that the internal, cognitive correlates of this state of conflict impact both the quality and quantity of children's day-to-day social interactions.

Of particular interest are the social interactions that socially anxious children have with their peers. In general, successful interactions are fluid, reciprocal, and involve a continuous give and take between social partners. Reciprocal engagement is often assessed via an individual's skill in initiating and maintaining conversation through a balance of sharing information with, and seeking information from, social partner(s) (Mesa et al., 2015). Overall, when compared to more socially comfortable peers, children high in social anxiety engage in fewer social interactions and are unlikely to initiate interactions with others (Spence et al., 1999). Furthermore, during social interactions, socially anxious children display poor eye contact and are slow to respond to others' social initiations during conversations (Spence et al., 1999). Therefore, not only do socially anxious children struggle in beginning social interactions with others, but once interacting, they display behaviours that disrupt social reciprocity. In addition to

the child's own behaviours, reciprocity may be further disrupted by social partners' responses or reactions to the socially anxious child's behaviours. Consistent with this view that socially anxious children elicit responses from their interaction partners, socially anxious youth are rated as less desirable social partners by their peers (Miers et al., 2010). Children high in social anxiety are more likely to experience peer rejection and poorer friendship quality (Luchetti et al., 2014), negative evaluations of social skills from peers (Miers et al., 2011), and low levels of social acceptance from familiar peers (Greco & Morris, 2005).

Social partners rely on each others' verbal and nonverbal cues to guide their own behaviours and responses. It may be particularly difficult for peers, and particularly unfamiliar peers, to interpret and understand the cues of socially anxious children. Clark and Wells (1995) hypothesized that children with social anxiety are viewed as poor social partners due to their inability to flexibly respond to their peers. This inflexibility may be due in part to socially anxious children's internally- focused thoughts or their preoccupation with how they are being perceived. Consequently, peers may incorrectly interpret this inflexibility as disinterest or dislike and as a result reduce their own effort to maintain or enhance the interaction in the moment or in the future. These evocative effects are evident early in development. For example, Walker et al. (2015) reported that children who were rated high in social fearfulness at age two were less socially engaged with an unfamiliar peer in the lab at age three. But importantly, after controlling for their own temperament, their unfamiliar peers were also less socially engaged. (Walker et al., 2015). This suggests that from early in development, children's social tendencies (i.e., social fearfulness) impact not only their own behaviours but those of their partners, impacting the reciprocity and quality of the interaction. It is likely that comparable evocative effects characterize the interactions of older children prone to social anxiety: their avoidant behaviours

and self-focused attention (i.e., concerns about others' evaluations) are difficult to interpret and impede the flow of an interaction, leading to changes in their social partner's behaviours as well.

As reported in Chapter Three, socially anxious children tend to hold negative expectations of others' social evaluations. It is hypothesized that socially anxious children may be preoccupied by these anticipatory concerns about their partner's reactions during social interactions. At a purely attentional level, ten-year-olds high in parent-reported social anxiety had greater difficulty disengaging their attention from angry versus neutral facial expressions during an affective orienting task (Morales et al., 2017). This may demonstrate that socially anxious children are preoccupied by others' threatening social signals, and this preoccupation may function to maintain or exacerbate socially anxious feelings. Over time, by repeatedly directing attention towards threatening social signals, socially anxious children may build up biased expectations of the frequency or likelihood that others will react negatively towards them. Consistent with this, past research has found that children who believe that others view them negatively (as assessed via hypothetical evaluative scenarios where participants must decide whether or not to endorse a catastrophic interpretation of a mildly negative social event) tend to also experience greater concurrent social anxiety symptoms (Vassilopoulos & Banerjee, 2008), as well as an increased risk of developing clinically significant social anxiety over time (Miers et al., 2013). Indeed, as demonstrated in Chapter Three, these expectations of negative evaluations by others were a critical factor that partially accounted for the association between self-reported social anxiety and lower self-esteem over the course of a year in middle childhood.

The goal of the current study was to extend the findings of Chapter Three by examining the relations between social anxiety, negative expectations of others' evaluations, and children's real-world social interactive behaviours. The aim of the study was to examine (a) the relations



between a child's self-reported social anxiety and their own and their partner's social engagement, and (b) the potential mediating role of children's expectations of others' evaluations on their own and their partner's social engagement. Based on previous literature (McElwain et al., 2014; Walker et al., 2015), it was hypothesized that (1) higher self-reported social anxiety would be associated with less social engagement in a child him/herself and his/her unfamiliar peer. It was also hypothesized that (2) negatively biased expectations of others' evaluations would be associated with less social engagement in a child him/herself and his/her unfamiliar peer. Finally, it was hypothesized that (3) negative evaluation biases would partially mediate the associations between social anxiety and children's own and their partner's social engagement.

## **Method**

### **Participants**

Participants were 65 9- to 11-year-old children (63.6% female), with a mean age of 10.14 years ( $SD = 0.78$ ). Participants were 90% Caucasian and recruited from a suburban Canadian area. As a proxy for socioeconomic status, parents were asked to report the highest level of education they obtained, as well as their annual household income. Thirty-two percent of mothers had an advanced or professional degree, 41% had an undergraduate university degree, 15% had completed a college program, 9% had some university/college experience, and 3% had a high school diploma. For paternal education, 36% of fathers had an advanced or professional degree, 30% had an undergraduate university degree, 18% had completed a college program, 11% had some university/college experience, and 5% had a high school diploma. Annual household income was > \$100,000/year for 53% of the sample, 27% earned between \$75,000–\$99,999, 17% earned between \$50,000–\$74,999, and 2% earned between \$25,000–\$49,999.

This study had an original planned sample size of 80 participants (40 dyads). Due to the COVID-19 worldwide pandemic, data collection was halted based on provincial and institutional policies implemented in March 2020. At this time, 65 participants had completed one of two study visits. These visits were counterbalanced, with children randomly assigned to complete a solo, self-report visit (Visit Individual: VI) or a dyadic, partnered visit (Visit Dyadic: VD) first: 33 children participated in VI first and 32 children participated in VD first. In this sample of 65 children, 62 were successfully paired for dyadic activities in VD, resulting in 31 dyads. In VI, 58 children provided self-report data on their social anxiety tendencies and 57 children completed the Mentalizing Task. A total of 54 children (27 dyads) had complete data on social anxiety, mentalizing, and the dyadic interaction, and are included in the data analyses below.

## **Procedure**

This study employed a cross-sectional design. Participants visited the research laboratory on two occasions. In VI, participants completed self-report measures in an individual visit, reporting on their social anxiety traits and mentalization tendencies. In VD, participants were paired with another participant, matched by age (having to be within two months of age to partner) and gender. During VD, participants engaged in dyadic activities with their unfamiliar peer in order to measure observed social behaviour. Of particular interest in this study was the Get to Know You (GTKY) task where, for the first five minutes of the interaction, children were left alone and simply told to “get to know each other.”

## **Measures**

### ***Social Anxiety***

Children’s social anxiety was assessed using the Screen for Child Anxiety Related Disorders – Child report (SCARED-C; Birmaher et al., 1999). The SCARED-C is a 41-item self-

report measure that asks children about their feelings of anxiety in a variety of scenarios and circumstances. Children respond using a three-point Likert scale (0 = not true or hardly ever true, 1 = sometimes true, 2 = true or often true), with higher scores indicating greater feelings of anxiety. The SCARED-C has been found to effectively discriminate between anxiety and depression as well as between different forms of anxiety (Birmaher et al., 1999). This measure has previously been used in non-clinical, community samples to assess trait-level differences in social anxiety (Poole & Schmidt, 2021). For the purpose of the study, the social anxiety subscale was used for analyses. This subscale includes 6 questions focusing on children's feelings of discomfort in social settings (e.g., *I feel nervous when I am with other children or adults, and I have to do something while they watch me*). Clinical cut-offs for this specific subscale have been identified as  $\geq 8$  (Ivarsson et al., 2018). For this sample, 37% of participants met the clinical cut-off. Internal consistency for this sample on social anxiety subscale was  $\alpha = 0.87$ .

### ***Expectations of Others' Evaluations***

The Mentalizing Task (Sharp et al. (2007) was used to assess children's expectations of others' evaluations. The Mentalizing Task consists of 15 peer-related social scenarios, designed to measure biases in children's mentalizing about others' perceptions of them. Each story presents a potentially stressful social scenario where children are prompted to imagine what others would think of them, should they be the protagonist in the story. This task has male and female versions and has previously been used in 7- to 11-year-olds (Sharp et al., 2007). Each story is accompanied by a cartoon image of the scenario and a multiple-choice option, with three potential responses: overly positive, neutral, and overly negative. An example of a scenario is: "*One day, Sally/Paul was playing by herself while all her classmates were playing football together*". After listening to the scenario, children were asked "*Imagine you were Sally/Paul. If*

*you were, what do you think the other kids would be thinking about you?”* and presented with the three following options: a) *Positive* – “They would think I’m cool and funny,” b) *Neutral* – “They would think I’m just doing my own thing,” and c) *Negative* – “They would think I have no friends”. This task has previously been found to demonstrate good reliability via a latent-class model analysis, demonstrating that the three response options loaded onto separate underlying classes of participants (Sharp et al., 2007). The three classes differentiated children’s response styles and associated socio-emotional wellbeing (e.g., Sharp et al., 2007). Internal consistency for this measure in the current sample was  $\alpha = 0.72$ .

Children’s total responses are summed to determine the number of positive, neutral, or negative responses overall (see Appendix E for descriptive data). In order to assess participants’ positive and negative biases in response to the evaluative social scenarios, difference scores were created by subtracting the frequency of neutral responses from the frequency of either negative or positive selections, respectively. These scores are referred to as ‘negative evaluation bias’ and ‘positive evaluation bias’ with higher scores indicating a greater number of negative or positive selections, respectively, and lower scores reflecting more neutral selections.

### ***Observed Social Behaviours***

Children’s social behaviours were observed during a Get to Know You (GTKY) task. In this task, two previously unfamiliar children are introduced to each other by a trained research assistant and then left alone in a study room for five minutes to get to know one another. The children are seated across a table from each other and given limited instructions in order to elicit independent sharing of information between the children. This task has a duration of five minutes and participants are video and audio recorded. Participant behaviour was coded offline, using Mangold’s (2016) INTERACT software. Behaviour was coded via three global codes that

captured participants' behaviour across the entire 5-minute task. These global codes were a) *Openness*: children's physical orientation, and relaxation during the task; b) *Social Ease*: children's physical displays of anxiety (reverse scored) and emotional flexibility; c) *Appropriateness of Conversation*: children's flexibility of conversation, sharing information and seeking information from their partner in an appropriate and engaged manner (see Appendix F for full coding guidelines and Appendix G for descriptive data).

Two coders were trained to score participants' behaviour during the GTKY task. Coders were blind to participants' responses on the SCARED-C and the Mentalizing Task. Inter-rater reliability was assessed on a sample of 9 dyads (29% of total sample). Intraclass correlations between pairs of coders were .90 for Openness, .84 for Social Ease, and .78 for Appropriateness, demonstrating moderate to high levels of agreement.

**Data Reduction.** The three global codes of the GTKY task were highly and positively correlated with one another ( $ps. <.001$ ; see Appendix G). In order to examine the viability of reducing the data down to one composite measure, a principal components analysis was conducted. This analysis revealed a single component that was later named Social Engagement (Openness, Social Ease, and Appropriateness of Conversation; eigenvalue = 2.30, loadings = .84-.94). The final Social Engagement composite score was created by averaging the z-scores for all three GTKY global scores to create a single score for each child.

### **Data Analysis Plan**

Data were analyzed for univariate outliers using criteria of absolute values of skew  $< 2$  and kurtosis  $< 7$  (West et al., 1995). Preliminary analyses were conducted to examine (a) the inter-relations among the primary study variables and (b) sex differences on mean levels of all study variables.

The primary study hypotheses were tested using an Actor-Partner Interdependence Model (APIM; Cook & Kenny, 2005). The APIM model is used to examine associations between the study variables while considering interdependencies between dyadic partners' behaviours. This model is used to test actor effects (i.e., children's own social anxiety or expectation biases in relation to their *own* social engagement) and partner effects (i.e., the effect of children's social anxiety or expectation biases on their *partner's* social engagement), while accounting for dyadic interdependence.

The dyads were indistinguishable, meaning that children within each dyad could not be distinguished from one another based on any specific characteristics (e.g., gender, age). This meant that all children were included as both actors and partners in a pairwise dataset. (Kenny et al., 2006). To test the primary study hypotheses, I planned to conduct four APIM models, via multilevel analyses, to investigate (a) the relations between social anxiety and social engagement, (b) the relations between negative evaluation biases and social engagement, and (c) the relations between positive evaluation biases and social anxiety. This third APIM model was conducted to test the specificity of the relations to *negative* expectation biases on the Mentalizing Task. Given that both the negative and positive expectation bias scores included neutral responses, it was important to examine this specificity. To test the non-independence of the models, partial intraclass correlations (ICCs) were calculated for each of the APIM models. The partial ICC represents the proportion of the variance as a result of the dyad, controlling for the effects of the predictor variables. For the three models examining the effects of social anxiety, negative evaluation bias, and positive evaluation bias on social engagement, the partial ICCs were 0.33, 0.34, and 0.32 respectively. These partial ICCs indicated that approximately 30% of the variance in social engagement, after controlling for the predictor variables, was shared at the

dyad level and therefore demonstrated interdependence in dyad members' levels of social engagement (Kenny et al., 2006). The final planned analysis was a mediated APIM, used to test the mediating role of negative expectation biases in the relation between social anxiety and social engagement. Prior to analyses, predictor variables were grand mean centred.

All analyses were conducted using SPSS 27 (IBM, 2021).

## Results

### Descriptive Analyses and Correlations

Descriptive statistics for all study variables are reported in Table 6. All continuous variables demonstrated good normality in their distributions, with absolute values of skew < 0.12 and kurtosis < -1.03 (see Appendix C for data visualization of SCARED-C scores).

Table 6

<i>Descriptive statistics for core study variables.</i>					
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Age (years)	65	10.17	0.78	9.00	11.92
Social anxiety	58	5.95	3.97	0.00	14.00
Negative evaluation bias	59	-4.16	5.00	-15.00	9.00
Positive evaluation bias	59	-3.48	3.94	-11.00	5.00
Social engagement	62	0.00	2.62	-8.14	4.69

Zero-order correlations (Table 7) showed that, contrary to expectations, children's self-reported social anxiety was not significantly correlated with either their negative evaluation biases or their observed social engagement ( $p > .05$ ). However, children's negative evaluation biases were inversely related to their observed social engagement ( $p = .005$ ). That is, children

who demonstrated more negative evaluation biases when predicting other children’s responses to them displayed lower levels of social engagement when observed interacting with an unfamiliar peer during the GTKY task.

Additionally, girls reported higher social anxiety  $r(58) = -.29, p = .03$ , but displayed more social engagement during the GTKY task,  $r(62) = -.34, p = .008$  (where sex is coded as female = 1, male = 2). Additionally, older children reported higher social anxiety  $r(58) = 0.32, p = .02$ . To account for these associations, sex and age were controlled for in the APIM analyses.

Table 7

*Zero-order correlations between core study variables.*

	1.	2.	3.	4.	5.	6.
1. Sex	-					
2. Age	-.07	-				
3. Social anxiety	-.29*	.32*	-			
4. Negative evaluation bias	.13	.11	.14	-		
5. Positive evaluation bias	.21	.10	.12	.48***	-	
6. Social engagement	-.34**	.21	-.04	-.39**	-.18	-

*Note.* \* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Sex: 1 = female; 2 = male.

Dyadic level correlations were also conducted to assess associations between dyad partners on study variables. Correlations for indistinguishable dyadic data showed that dyad partners’ self-reports of social anxiety and their positive and negative evaluation biases were unrelated ( $ps > .11$ ), as would be expected based on their random pairings. There was, however, a significant and positive association between dyad partners observed social engagement:  $r(31) =$



.42,  $p = .02$ . This indicated that children who displayed high levels of social engagement had partners who also showed high levels of social engagement.

### Actor-Partner Interdependence Models

Results for the three APIM models, each controlling for participant sex, are reported in Table 8.

The first APIM model revealed that contrary to my hypothesis, self-reports of social anxiety were not associated with children’s own (i.e., actor effect) or their peer’s (i.e., partner effect) observed social engagement.

The second APIM revealed that children’s negative evaluation biases were inversely associated with their own (i.e., actor effect) social engagement, such that a greater negative evaluation bias was associated with lower social engagement ( $p = .007$ ). However, children’s negative evaluation biases were unrelated to their dyad partner’s social engagement (i.e., there was not a partner effect).

The third APIM analysis examining positive evaluation biases in relation to social engagement was not significant.

Table 8.

<i>Actor-partner interdependence models predicting social engagement.</i>					
	Social engagement				
	<i>b</i>	<i>SE</i>	<i>p-value</i>	<i>Lower CI</i>	<i>Upper CI</i>
<b>Social anxiety</b>					
Actor	-.15	.16	.92	-.31	.34
Partner	.07	.13	.59	-.20	.34
<b>Negative evaluation bias</b>					
Actor	-.33	.11	.007**	-.57	-.10
Partner	.001	.11	.99	-.22	.22
<b>Positive evaluation bias</b>					
Actor	-.1	.14	.171	-.50	.09
Partner	-.05	.14	.71	-.24	.35

Note. \*\*  $p < .01$

Due to the unexpected lack of association between social anxiety and negative evaluation biases, the final planned analysis, a mediated APIM, was not conducted. This was due to the violation of the required element of a significant association between the predictor variable and the mediator variable.

## **Discussion**

The results of this study extend the findings from Chapter Three, in an independent sample of children, by relating children's self-reported social anxiety and expectations of others' evaluations to their real-world behaviours during an initial interaction with an unfamiliar peer. Contrary to my hypothesis, social anxiety was unrelated to children's own, or their partner's, social engagement during a brief, unstructured interaction in the lab. Furthermore, social anxiety was unrelated to children's negative expectations of others' evaluations, in contrast to what was reported in Chapter Three. Importantly, though, children's negative expectations were associated with lower levels of observed social engagement in themselves, but not their social partner. The results of this study indicate that children's mentalizing tendencies, and specifically their expectations of how others perceive them, are directly related to their observable behaviours in novel social contexts.

Contrary to the first hypothesis, children's self-reported social anxiety was unrelated to their own social engagement during the Get to Know You (GTKY) task. This contradicts several past studies in the literature relating informant reports of temperamental fear and social anxiety to children's observed social behaviours (McElwain et al., 2014; Spence et al., 1999; Walker et al., 2015). There are several factors that may explain why this association was not observed in the current study. First, the children in the current sample are older than those in the Walker et al. (2015) and McElwain et al. (2014) papers that focused on preschool-aged children. In the current

sample children ranged in age from nine to eleven years. By this age, children likely have had substantial experience interacting with novel peers, suggesting that the brief five-minute GTKY task may not be as unfamiliar or as distressing as it is for younger children. Based on descriptive data across the full sample, children generally scored quite high on the three components (i.e., Openness, Social Ease, and Appropriateness of Conversation; see Appendix G for descriptive data) that formed the observed social engagement composite score. By preadolescence, the children in the current study have likely encountered other situations where they must introduce themselves one-on-one to an unfamiliar peer (e.g., the first day of school, at camp, etc.). These experiences allow children to develop social scripts, a series of practiced steps that help individuals navigate social encounters that are novel and potentially uncomfortable (Ganz et al., 2008; Goldstein, 2002). The use of social scripts may provide an explanation for the interesting yet unexpected finding that girls rated themselves higher in social anxiety than boys, but also displayed higher levels of social engagement during the GTKY task. It may be that girls are more strongly socialized to engage with others and to mask their own feelings of discomfort (Sedgewick et al., 2019). As a result, girls may then have more practice creating and following social scripts (Eschenbeck et al., 2007; see Chapter Five for further discussion of this point). In future studies, it will be important to consider other lab paradigms that may evoke observable social discomfort in preadolescent-aged samples more reliably (e.g., presenting oneself in front of a large group with the potential for being evaluated). In addition, longer observation periods may exhaust children's opportunities to rely on social scripts (i.e., what to say once you have moved past "*Hello, my name is*" and "*What is your name?*" etc.), and more directly tap into their reactions, skills, and competencies in novel social situations.

Also contrary to the hypothesis, children's social anxiety did not elicit differential responses from their partners. This is not surprising as self-reported social anxiety was not directly related to observable differences in children's own social engagement. It may be that the global coding of social engagement was not sensitive to some of the intricacies and subtleties of preadolescents' socially anxious behaviours. More fine-tuned coding that accounts for the temporal aspects of an interaction (i.e., latency to speak and respond to a partner; maintenance of eye contact) and/or more fine-grained analyses of facial expressions may reveal these more subtle differences. It will be interesting in future studies to see how novel social partners' styles of engaging with one another change over a longer period of time, such as a longer study visit or across repeated meetings. This longer exposure may make more subtle differences in social engagement more evident for coding as children may no longer be able to rely on the aforementioned social scripts. This may result in greater variability in observed social behaviours, as children with social anxiety may begin, over time, to demonstrate greater difficulties in coping with the social interaction. As a result, the partners of socially anxious children may begin to adapt their own behaviour in return, either encouraging their anxious peer or withdrawing in the face of their peer's anxiety.

In contrast to the findings from Chapter Three, there was not a relation between children's self-reported social anxiety and their negative expectations of others' evaluations on the Mentalizing Task. Again, the difference in age across samples may account for these divergent findings. The children in Chapter Three were around 8 years of age ( $M_{years} = 8.35, SD = 0.30$ ) while the current sample was on average 10 years of age ( $M_{years} = 10.14, SD = 0.78$ ). Despite comparable means and standard deviations for social anxiety and negative expectation biases across samples, the association between the two variables differed. As children age, it could be

that individual differences in social information processing are more influenced by social experiences than within-child temperamental differences. For example, children who have experienced victimization from others at eight years have been found to demonstrate an increased hostile attribution bias in how they view socio-evaluative contexts at age ten (Yao & Enright, 2021). Early social withdrawal has previously been found to be associated with earlier, more sophisticated theory of mind (Lane & Bowman, 2021; Mink et al., 2014; Moore et al., 2011), indicating that socially withdrawn children become aware of the role and differences of others' mindsets earlier in development than other children their age. It may be that more socially anxious children are not wrong in seeing the negative risk of the social world – they may simply be precocious, understanding these stressors before their peers. With time and more exposure, non-socially anxious children begin to catch up and internalize a variety of social stressors as well. Indeed, as children become older, they begin to recognize that certain socio-evaluative contexts may be more or less negative/stressful (Nelson, 2017). Future work should look at the developmental trajectory of exactly when socially anxious versus non-socially anxious children begin to develop negative expectations of others' evaluations, via repeated assessment of child social anxiety and evaluation expectation biases over time. It is expected that socially anxious children will begin to demonstrate negative expectation biases earlier than their non-socially anxious peers, but that with age they may become more similar.

Critically, though, children who reported more negative expectations regarding others' evaluations were observed to be less socially engaged with their partner during the GTKY task. In general, this finding demonstrates that negative expectations of hypothetical others' evaluations influence in-the-moment perceptions and experiences during unstructured social interactions. Children who anticipate that others will judge them negatively have been found to

perform more poorly, and experience greater anxiety, following a speech performance task (Miers et al., 2011). There are at least two plausible explanations for the association between negative expectations of others' evaluations and reductions in social engagement: excessively self-focused attention and/or active social avoidance. In the first, children who anticipate negative evaluation from others may find the GTKY task to be especially stressful. The combination of an unfamiliar setting and a novel peer, as well as limited instructions or guidance on what to do in the task, on top of their pre-existing anticipation of negative responses from others may be experienced as stressful. When stressed, individuals tend to shift their attention inward as they process the most crucial information, ignoring others' social cues and therefore reducing the amount of contingent/coordinated emotion and behaviour with their partner (Finan et al., 2011). In the current study, children may be preoccupied with their thoughts and worries about how they are being perceived which in turn leads them to have difficulty engaging in fluid, reciprocal interactions with their peer. A second reason negative expectations might detract from social engagement is through active social avoidance or self-protection. The urge to protect oneself from social evaluation is an instinctive drive (Rubin et al., 2006). In the case of social settings, children who expect negative evaluations from others may actively choose not to engage so peers' have nothing to evaluate (Rubin et al., 2006). While this behaviour may be protective in the short-term, it may present to others as socially unskilled, disinterested, and/or unfriendly. In the current study, despite children's negative expectations of evaluations impacting their own social engagement, there was no evidence that it led to changes in their social partner's behaviour. This may once again be an effect of the very limited exposure the dyads had to one another over the course of the five-minute task. Longer exposure between dyadic partners may give more time for children to become aware of each other's social

discomfort and begin to interpret the reasoning behind the discomfort. It may be that, with time, dyadic partners are better able to observe each other's behaviour and begin to generate explanations for their partner's behaviour. One way to assess dyadic partners' evaluations of one another would be to ask each child at different points during a dyadic interaction, "*How do you think your partner was feeling? Why do you think that?*", as well as asking the child themselves, "*How did you feel during the interaction? Why did you feel that way?*" By gathering this data from each child and comparing, it may be possible to see whether children are able to (a) identify emotional/mental states in a partner based on observable behaviours, (b) whether they can mentalize a cause of these emotional/mental states, and finally (c), to determine whether children's assessment and mentalization of their partner's behaviour matches the true experience of the partner, in an assessment of children's accuracy in identifying and understanding social behaviours in others. By measuring these at repeated points across the interaction/visit, it will be possible to determine whether children's mentalization changes and becomes more/less accurate with greater exposure/familiarity to a dyadic partner and their behaviours.

In March of 2020, the University of Waterloo halted all face-to-face data collection due to the worldwide COVID-19 pandemic. Due to this, data collection for the current study was cut short and did not resume. The unique face-to-face, dyadic protocols of this study (requiring multiple participants in one room, requiring visibility of facial expressions without masks, heart rate monitoring) did not allow the protocol to be fully adapted for online data collection. As a result, the sample size was quite a bit smaller than anticipated, limiting the power to detect differences that might truly exist. Increasing the sample size of the study by including more children could address this power issue; however, I anticipate that data collection would have to begin anew. Children who participated pre-pandemic may differ from children who might

participate after the pandemic, reflecting the unique cohort effects associated with COVID-19 including altered socialization experiences and mental health challenges (Cost et al., 2021). This could result in children's experiences of social anxiety, as well as social interactions with unfamiliar peers, being fundamentally different than those of same-aged children pre-pandemic. As a result, to fully conduct the planned analyses, data collection would need to begin with an entirely new sample of children.

Children with negative expectations of others' social evaluation were less socially engaged when first getting to know a previously unfamiliar peer in the lab. While I was surprised that self-reported social anxiety was unrelated to either observed behaviour or expectations of others' evaluations, I did uncover a novel and important association between negative expectation biases and real-world social behaviour. This finding is important in understanding how children's own internal cognitions might ultimately express themselves to other people, impacting the quantity and quality of their social experiences in the real world. Socially wary children are often encouraged to engage in social skills training programs (Mesa et al., 2015). However, it may not be enough to just teach children to enact specific social behaviours: the current study suggests that it is also key to consider children's mentalizing tendencies surrounding their expectations regarding others' evaluations. These expectations are most likely formed over years of accumulated experience, and socially anxious children rely on this past knowledge to form their expectations of their future. This is of significance to parents, educators, and child interventionists who may seek to assist children in developing better quality social interactions with peers, as social skills training to encourage greater social competence is likely to be less successful without the consideration of children's unique mentalizing tendencies.



## Chapter Five: General Discussion

### Summary of Findings

Children enter new social interactions with unique perspectives and expectations based on a lifetime of accumulated social experiences. In three studies, I investigated the relations between children's self-reported social anxiety and different aspects of social information processing (SIP), primarily mentalization, and how, together, these were associated with children's socio-emotional development. In Chapter Two, I examined how children's social anxiety at age seven was associated with their concurrent identification of, and mentalizing about, others' emotional displays (i.e., path A of Figure 1) and how these together predicted social anxiety at age eight. Children higher in social anxiety were more accurate when identifying emotions from dynamic displays and tended to over mentalize about the reasons for others' emotions. Importantly, social anxiety and both under and over mentalizing biases together predicted higher social anxiety one year later, illustrating the critical moderating role of mentalization on the development of social anxiety over time (addressing path B of Figure 1). In Chapter Three, I extended my assessment of mentalization (via paths A and B of Figure 1) to examine children's expectations of others' evaluations. Specifically, I examined how social anxiety at age seven predicted expectations of others' evaluations and self-esteem at age eight in the same sample of children reported on in Chapter Two. The results presented in Chapter Three demonstrated that social anxiety at age seven was associated with reduced self-esteem at age eight and that this effect was partially mediated through negative expectations regarding others' evaluations. Finally, in Chapter Four, I extended these findings to examine the relations between 9- to 11-year-old children's social anxiety, expectations of others' evaluations, and observed social engagement with an unfamiliar peer in a dyadic interaction task (addressing Path C of

Figure 1). I also examined the effects of children's social anxiety and expectations of others' evaluations on their peer's observed social engagement. Surprisingly, social anxiety was unrelated to negative expectations or observed social behaviour, at either the actor or partner level; however, children's negative expectations of others' evaluations were associated with lower levels of observed social engagement.

Taken together, the findings of these studies address the first three paths of my conceptual model and contribute to our understanding of *how* and *why* individual differences in socially anxious tendencies impact children's socio-emotional development. Below I discuss three themes that emerged across these studies and their theoretical and practical implications. These themes generate many avenues for future research and raise interesting developmental questions regarding the transactional processes that link children's socially anxious traits with their ways of thinking and behaving in social contexts.

### **The Role of Context in Social Information Processing**

According to the SIP model, the initial step of identifying others' social cues is directly guided by children's accumulated *database* that is comprised of implicit memories of past social experiences including their personal successes and failures (Crick & Dodge, 1994). This database provides each child with their own default lens through which they filter all incoming social information. However, a recent reconceptualization of the SIP model suggests that the relative influence of this default perspective on information processing may change based on a host of social-contextual factors (Verhoef et al., 2021). Specifically, in high stress contexts, SIP becomes highly automated and instinctive, and draws heavily on an individual child's database. In contrast, though, in familiar or low-stress contexts, SIP can be more reflective and flexible (Verhoef et al., 2021), allowing children to think broadly and to reflect on specifics of the

context when interpreting social cues. In a sense, under such conditions of familiarity and comfort, children can over-ride their default, instinctual, database-driven style of responding, allowing them to generate more situation-specific and appropriate responses (Verhoef et al., 2021).

Several aspects of my findings support the idea that the implementation of SIP is context dependent. For example, in Chapter Two, social anxiety was associated with enhanced emotion identification but only when children were viewing dynamic, but not static, stimuli. Social anxiety describes children's reactions to novel social contexts – which, by definition, are dynamic (e.g., meeting new people, joining a new class). It may be then that dynamic social scenes are experienced as more similar to children's real-world social experiences, and therefore activate or potentiate their unique, default databases. In contrast, viewing static images may be significantly less arousing for children and in turn fail to potentiate default, reactive modes of processing social information. In future studies, it will be interesting to investigate physiological arousal during both static and dynamic stimulus presentations, to determine whether social anxiety is indeed associated with more arousal to dynamic stimuli and if this arousal, in turn, predicts emotion identification accuracy.

Context also appears to impact more complex forms of SIP including mentalizing. In Chapter Three, I asked children to imagine themselves in the context of a potentially stressful, peer-related scenario. I found that higher levels of self-reported social anxiety were associated with more negative expectations of others' evaluations. There are two potential explanations for this finding. First, socially anxious children may engage in excessive anticipatory worry that they will be negatively evaluated by others in a future interaction, and this worry may be disproportionate to the actual probability of being received negatively (i.e., a bias). It may be that

some children have a negatively biased view of social situations that is not rooted in fact and reflects poor understanding of social cues, as previous work has found that children high in social anxiety traits tend to show poorer social cognition skills (i.e., recognizing emotions in others via body language and facial expression; Pearcey et al., 2021). My work, however, found the opposite in that socially anxious children were *more* accurate in identifying others' emotions from dynamic displays (Chapter Two). Therefore, another explanation for the association between socially anxious traits and negative evaluation expectations may be that socially anxious children actually have faced negative evaluations in the past and have incorporated these experiences into their default SIP database. As early as infancy and toddlerhood, children who are more fearful and less socially confident tend to elicit a wide range of responses from adults. For example, parents can be overprotective of socially anxious children and teach them that the outside world is threatening, or parents can view social anxiety as a flaw and criticize children, negatively impacting their self-esteem (Rubin, 2010). Similarly, same-age peers tend to believe that withdrawn children are disinterested or unwilling to interact socially (Coplan et al., 2007), resulting in peer exclusion and fewer positive peer interactions (Fox & Boulton, 2005; Greco & Morris, 2005). Therefore, when put into the context of imagining themselves as the protagonist in potentially stressful and evaluative social contexts, socially anxious children may draw upon unique SIP databases that include rich and detailed memories of past negative evaluations from others.

Some of the findings from Chapter Four were puzzling, yet intriguing, when considering the form and function of children's social information processing databases. Specifically, self-reported social anxiety was unrelated to negative expectation biases (in contrast to the association found in Chapter Three) and unrelated to children's observed social engagement with

an unfamiliar peer (in contrast to several past studies in the literature; e.g., Spence et al., 1999). As discussed in Chapter Four, the findings should be interpreted cautiously as this sample was quite small and underpowered with data collection halted due to the COVID-19 pandemic. However, the findings may still form an intriguing perspective. While it is challenging to interpret null findings, Verhoef et al.'s (2021) modified SIP model provides some interesting ideas. Specifically, the children in Chapter Four were on average two years older than the children in Chapter Three. It is possible that by this age, children have enough experience and instruction that they develop clear social scripts for navigating new and brief social interactions (e.g., *“Hi, what’s your name? My name is Piper. What school do you go to? I go to this school.”*). Social scripts provide an internal guideline of what to say and how to behave when in common social situations such as meeting someone for the first time (Goldstein, 2002). Socially anxious children may be particularly reliant on these social scripts to alleviate some of the stress associated with novel social contexts (Ganz et al., 2008). This interpretation may account for why there was a lack of association between child social anxiety and observed social behaviour in Chapter Four: socially anxious children may have developed social scripts that overcame their anxiety via the practiced steps of their script. Over time, these scripts can become practiced and routinized and provide an easy way to cope with the stress of new social interactions. These scripts may allow the individual to override the automaticity or default response of their personal database and allow them to engage in more reflective processing, taking the time to reflect on the specific situation to reduce perceptions of threat and feelings of stress.

Additionally, though not hypothesized, there were interesting patterns of sex differences that also raise questions about contextual influences on social information processing. In Chapter Four, unlike in the earlier chapters, girls self-reported higher levels of social anxiety on

the SCARED-C than boys did. Interestingly, in this same sample, girls were also observed to be *more* socially engaged with an unfamiliar peer compared to boys. At face value, these two findings appear at odds, as typically higher social anxiety is associated with less social engagement (Spence et al., 1999). However, the idea of social scripts may help account for these findings. Specifically, it may be that by late childhood, girls have been disproportionately socialized to engage in socially affiliative ways (Eschenbeck et al., 2007; Sedgewick et al., 2019). When asked how they would respond in hypothetical social scenarios, girls aged 8-12 report more prosocial strategies than their male counterparts (Mewhort-Buist et al., 2020). It may be that girls have more practice using social scripts in general, therefore appearing, on the surface, more socially comfortable and engaged. A further difference, though not investigated in my work thus far, may also be the role of cultural differences in social anxiety and social engagement. Research into the variation of social anxiety by cultural upbringing has found that children raised in Eastern versus Western cultures tend to experience less visible social anxiety to outside observers, as well as having different motivations for social anxiety (Spence & Rapee, 2016). This additional individual difference may provide a difference in children's understanding of social contexts, thereby influencing their unique social scripts. Future research should investigate the point at which social scripts are no longer a useful tool for coping in unfamiliar or stressful contexts. This could be done by manipulating task-related factors to increase stress or reduce the effectiveness of practiced scripts (e.g., increase the length of the interaction, form mixed sex versus same sex dyads, provide task instructions that promote less routine social exchanges that can rely on scripts and instead encourage flexible or creative thinking [e.g., "*You must make a list together of ten items to bring to a desert island and you must agree on and rank*"]

*the items as a team.*”]). These factors could push the stressors of unfamiliarity to an extent where scripts are no longer sufficient for buffering the experiences of children high in social anxiety.

These tasks manipulations are consistent with previous research on temperament and SIP, as well as my own, in that they focus on designing laboratory paradigms that trigger or amplify specific reaction tendencies (e.g., observing socially anxious children under stress in an unfamiliar environment). However, my interpretation of the lack of associations in Chapter Four as potential evidence for the ability to over-ride the automatic implementation of biased social information processing strategies suggests an alternate approach to this line of research. Instead of only examining how the SIP database reacts under stress, future work should use within-person designs to directly compare socially anxious children’s SIP tendencies across contexts that vary in how stress inducing they are to identify contextual factors that optimize adaptive SIP tendencies. One interesting design in this respect would be a repeated-measure dyadic design; in this, children would engage in repeated dyadic interactions with different partners in a ‘one with many design’ (see Chapter Four for further discussion; Brinberg et al., 2021; Kenny et al., 2006). In this design characteristics of the dyad (e.g., peer familiarity, dyadic similarity in temperament) could be manipulated to examine the contexts under which children are most accurate (or least biased) in their interpretations of the interactions. In each of these contexts, children could be asked to estimate how they are being perceived by their partner (meta-perceptions; e.g., “*What do you think Lucy thinks about you?*”) and partners could be asked how they perceive their peer (perceptions; e.g., “*What do you think of Feargus?*”; see Usher et al., 2018). It may be that in certain contexts and interactions with partners, children demonstrate greater accuracy in evaluating their partners’ perceptions highlighting the role of social context in over-riding within-person tendencies and biases.

## **The Role of Attention Processes in Mitigating Risk and Promoting Resilience for Socially Anxious Children**

A central goal of my dissertation studies was to investigate socially anxious children's style of processing social information and specifically their emotion identification and mentalizing abilities. In terms of mentalizing, I studied the ways in which children reasoned about (1) others' emotional cues and (2) others' evaluations of themselves. An assumption of my program of research is that temperamental traits guide children's social attention and that, in turn, patterns of social attention impact children's perception and interpretation of social information. As such, in future work it will be interesting to better understand the connections between basic attention processes and socially anxious children's SIP tendencies. One avenue of investigation in this regard is to consider the literature on temperament and executive functioning. The SIP model suggests that individuals selectively focus their attention on information of immediate relevance to themselves. The role of attention, both the tendency to have attention drawn into, and the ability to shift attention away from, salient cues can be investigated via the lens of executive functioning (Verhoef et al., 2021). Executive functioning is the collection of cognitive skills, including inhibitory control, attentional flexibility, and working memory, that guide goal-directed behaviour (Davidson et al., 2006). The link between social anxiety and executive functioning has been examined in a multitude of ways (e.g., Nilsen et al., 2021; Troller-Renfree et al., 2019). However, most relevant to my dissertation studies are the dimensions of inhibitory control and attentional flexibility.

Inhibitory control is the ability to refrain from performing a dominant response in favour of a subdominant response that is more suitable for a specific context or to support goal-directed behaviour (Perez-Edgar & Fox, 2005; Posner & Petersen, 1990). Much of the literature on



inhibitory control focuses on the implications of too little inhibitory control (e.g., talking too loudly in a quiet room, choosing smaller immediate rewards over larger but delayed rewards; (Posner & Petersen, 1990). In a social setting, greater inhibitory control is often viewed as adaptive in that it can help children mask emotions in the service of social harmony (e.g., pretending to be happy even if disappointed; Kieras et al., 2005). In contrast, though, socially fearful children can be thought of as having *too much* inhibitory control or being overcontrolled (see Henderson et al., 2015). In this scenario, socially fearful children may display excessive control that makes it more difficult to engage in flexible, social interactions due to a preoccupation on maintaining appropriate behaviour (White et al., 2011). This preoccupation may be perceived as a rigid or disengaged, resulting in poor social perceptions from peers and other social partners (Coplan et al., 2004; White et al., 2011). In support of this argument, it has been found that children high in behavioural inhibition (a developmental precursor of social anxiety) and inhibitory control (as assessed using Flanker or Go/NoGo tasks) tend to be at heightened risk of developing clinically significant social anxiety over time (Fox et al., 2021; Henderson et al., 2015; White et al., 2011; Wilson & Henderson, 2020). In the context of my own work, it will be interesting in future studies to investigate whether basic attention processes such as inhibitory control might mediate the associations social anxiety and mentalizing biases.

While empirical evidence suggests that inhibitory control might amplify risk among socially fearful children, there is complementary evidence suggesting that attentional flexibility may be protective. Attentional flexibility describes the ability to disengage attention from one cue and reengage attention to another cue in the service of a goal-directed behaviour (Posner & Petersen, 1990). Typically, a flexible state of control is considered to be the most adaptive and to underlie behavioural and emotional regulation (Cragg & Chevalier, 2012). Too little flexibility

results in a lack of attention shifting and can be seen on a behavioural level as hypervigilance while in a social setting, fixating on social cues from others without directly engaging with others (Stahl & Pry, 2002). In socially fearful children, the ability to flexibly shift attention may be particularly adaptive. In the White et al. (2011) paper cited above, toddlers high in behavioral inhibition who performed relatively well on an attention flexibility task (the Dimensional Change Card Sorting task) showed significantly fewer anxiety symptoms at age four than did those who performed less well on the task. Again, it will be interesting in future studies to bridge the gap between assessments of basic executive functioning skills and children's SIP tendencies. For example, does inhibitory control increase the probability that children rely on their default SIP database (i.e., hold negatively biased expectations) and does attentional flexibility allow children to better modify their SIP tendencies by engaging in a more reflective analysis of social contextual cues.

### **Social Information Processing in Socially Anxious Children: A Goldilocks Effect**

The results of my dissertation studies suggest that engaging in too little or too much mentalizing, or more negative (versus neutral) mentalizing, can be maladaptive for social functioning for socially anxious children (Chapter Two and Three) and children in general (Chapter Four). Together these findings suggest that what may be most adaptive is achieving some sort of 'happy medium', where socially anxious children are aware of social information but are not fixated on, or overwhelmed by, the information, flexibly shifting their attention from in-the-moment stressors and considering the broader context in which a social interaction is taking place. This idea of a happy medium is referred to as the 'Goldilocks principle', a U-shaped function where the middle zone is the most adaptive. This is based upon the fairy tale of 'Goldilocks and the Three Bears', with one option being too much, another not enough, but a

third option being ‘just right’ (Przybylski & Weinstein, 2017). The Goldilocks principle has been invoked to explain findings in many domains of developmental science. For example, in the field of visual perception newborns tend to look longer at visual stimuli that are not too simple or too complex, looking longest at stimuli of mid-level complexity that catch and hold their attention but are not experienced as overwhelming (Kidd et al., 2012). In the field of language learning, three- to five-year-olds learned a novel language most easily when a televised lesson included moderate levels of social interactivity (Nussenbaum & Amso, 2016). Beyond basic language and learning, the Goldilocks principle applies to several findings relating trait differences to observed social behaviours. For example, Hassan and Schmidt (2021) reported that preschool-aged children who demonstrated high or low levels of inhibitory control (as assessed via maternal report, as well as performance on lab tasks) were more likely to demonstrate avoidant social behaviours and poorer mental health (i.e., externalizing and internalizing behaviours) a year later relative to children who displayed average levels of IC (Hassan & Schmidt, 2021).

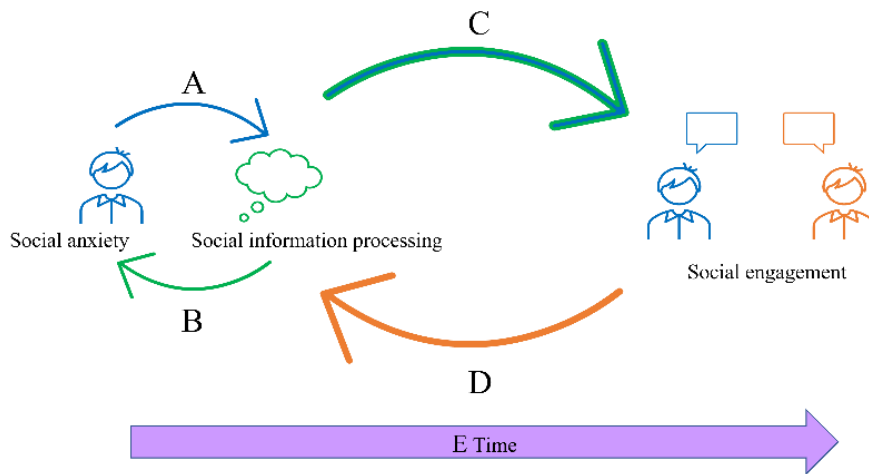
In examining the findings of my dissertation, the adaptive nature of a middle ground response was demonstrated in several ways. Descriptive data on mentalizing measures across all three studies demonstrated that the ‘middle’ response was normative (i.e., provided most frequently by participants) in these community samples of children. In terms of mentalizing (Chapter Two), most children provided correct mentalizing responses that followed simple cause and effect logic when asked why protagonists in films were expressing each emotion. As for valence (Chapters Three and Four), when asked how others would evaluate them in a hypothetical social scenario, most children selected the neutral option. Additionally, correlational analyses linking both mentalizing styles to social-emotional functioning demonstrated that these middle ground response patterns were adaptive. For example, in Chapter Two, socially anxious

children who provided more correct (versus under or over) mentalizing responses at age seven did not demonstrate stability of social anxiety over the course of a year. In Chapter Three, children who held more neutral than negative expectations of others' evaluations reported lower social anxiety and higher self-esteem. Similarly, in Chapter Four, children who held a more neutral than negative expectations of others' evaluations were more socially engaged during an interaction with an unfamiliar peer. Taken together, these findings are relevant in considering prevention and intervention efforts targeting children's mentalizing styles. The best recommendation may not always be guiding children towards extremes (i.e., "*Think really carefully about how [a peer] is feeling*" or "*just think positively/look on the bright side...*") but rather encouraging them to use the information available, no less and no more, to make judgments. This form of thinking is known as cognitive restructuring or reframing and is commonly used in cognitive-behavioural therapy, wherein socially anxious youth are encouraged to look at the facts of a situation without drawing too many emotional conclusions (Sauter et al., 2009). Socially anxious children are more likely to benefit from interventions that guide them in the re-evaluation of social interactions, moving from their automatic, negative expectation of evaluation from others and towards a more moderate and/or realistic interpretation of the interaction (Hudson et al., 2015). This approach may be beneficial for all children, regardless of their level of social anxiety, guiding them towards a more measured, middle ground perspective of the world around them.

### **Social Anxiety and Social Information Processing Across Development**

My dissertation studies demonstrated concurrent and short-term longitudinal associations between social anxiety, mentalizing, and social-emotional functioning. However, temperament theory, SIP theory, and my own conceptual model suggest that these constructs are reciprocally

related from early in development and continue to impact one another throughout childhood and adolescence (and likely beyond). This continual cycle is depicted in path E of my conceptual model. Importantly, the inclusion of developmental time implies that the within-child social and mentalizing tendencies (paths A and B), and social experiences (paths C and D) reciprocally influence each other over extended periods of time (path E).



*Figure 6.* Conceptual model guiding dissertation studies, extended to incorporate developmental time.

My research questions were guided in large part by temperament theory in which socially anxious traits in childhood are driven in large part by early and relatively stable differences in children’s approach/withdrawal tendencies. Given the early appearance of temperamental differences, my assumption is that they shape, in part, individual differences in later developing social cognitive abilities and in turn later social-emotional functioning. This has been supported in previous research, establishing that early temperamental tendencies such as behavioural inhibition predict children’s later cognitive tendencies and emotional and behavioural outcomes such as increased risk for clinically significant social anxiety (Buzzell et al., 2017; Troller-

Renfree et al., 2019). Furthermore, in considering children's social cognition, while there does tend to be a stability in children's social information processing from infancy to adulthood, this trajectory can be affected by individual differences in areas such as executive functioning (specifically inhibitory control; Vetter et al., 2013). With this in mind, it is likely that over time, the associations between social anxiety, social information processing, and socio-emotional functioning are not simply unidirectional but rather bidirectional. These bidirectional effects 'snowball', or generate a developmental cascade via their continuous and reciprocal interactions (Masten & Cicchetti, 2010). Furthermore, while some effects may be in-the-moment, such as social anxiety increasing the risk of viewing social interactions more negatively, cascading effects may only appear over time. Therefore, it may be difficult to predict long-term implications for children's socio-cognitive and emotional wellbeing, without additional follow-up and longitudinal research. In the context of my dissertation, as outlined in my conceptual model (bidirectional arrows in Figure 6), children's social anxiety may predict SIP biases (path A), as their internal perceptions of the world shape the way in which they perceive information and may create inaccurate biases. In turn, these biased perceptions may increase children's feelings of social anxiety (path B). However, it may be that these 'biases' are not simply formed based on temperament differences but instead informed also by socially anxious children's actual experiences in social interactions. In either case, these perceptions likely shape behaviour which is then perceived by others in the social world (path C), prompting reactions that are received by the child (path D) that shape their future expectations of the world (their database). Over time, this continuous and reciprocal model will drive children's long-term outcomes (path E). The only way to model these reciprocal effects and developmental cascades will be to examine the inter-relations among these constructs using repeated assessments over an extended period of time.

## **Conclusions**

My dissertation studies show that socially anxious traits are associated with specific styles of reasoning about others and oneself and that these thought patterns are related to emotional (self-esteem) and social (social engagement with an unfamiliar peer) functioning. These styles of reasoning reflect a cognitive lens, hypothesized to reflect one's unique history of social experiences and one's expectations for future social interactions. A socially anxious child's lens impacts their day-to-day processing of social information which over time impacts broader aspects of socio-emotional wellbeing. By better understanding these inter-relations, prevention and intervention efforts can support socially anxious children by promoting their strengths (e.g., emotion identification, understanding of others) and overcoming their barriers (e.g., negative expectations, poor self-esteem). From a long-term developmental perspective, this understanding and support will hopefully diminish the risk of maladaptive developmental cascades and promote adaptive functioning for children high in socially anxious trait.

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## Appendices

## Appendix A

### Coding scheme for free responses to Reading Mind in Films (Chapter Two)

*Under mentalizing* – situational details or physical action by person/object with no consideration to how that affects emotion/thought process

- ‘The door opened’
- ‘The girl said something’
- ‘The man came in’
- ‘She was in a room’
- ‘There were people’
- Description of a display of emotion\*
- Suggestions (‘they should go help her’) – doesn’t consider any mental states

*Correct mentalizing* – consideration of how something affects emotion/thought process (can include physical actions as well as situational details)

- **This** caused **this** reaction, typically
- Uses a descriptor ‘rude, scary, mean’
- Describes how it made the person feel/think (more than just “it was dark”. why is dark bad?)
- Compliments\*
- ‘Wondering what happened’ is correct because they are considering a mental state
- ‘Because she doesn’t like that guy’ is correct (not over mentalizing because it doesn’t give specific details from the past – ‘because he’s been mean to her before’)

*Over mentalizing* – over interpretation of mental state or effect of action

- Consideration of previous mental state – ‘she had been stressed all day’, ‘he didn’t like them’
- Consideration of future effects – ‘now no one will ever like her’
- Over explanation of the situation – too many details
- Consideration of other person’s thought process – ‘the girl wanted to hurt her feelings, so she said something mean’
- Double jump/multiple perspectives

## Appendix B

### Response data for dynamic emotion identification task mentalizing (Chapter Two)

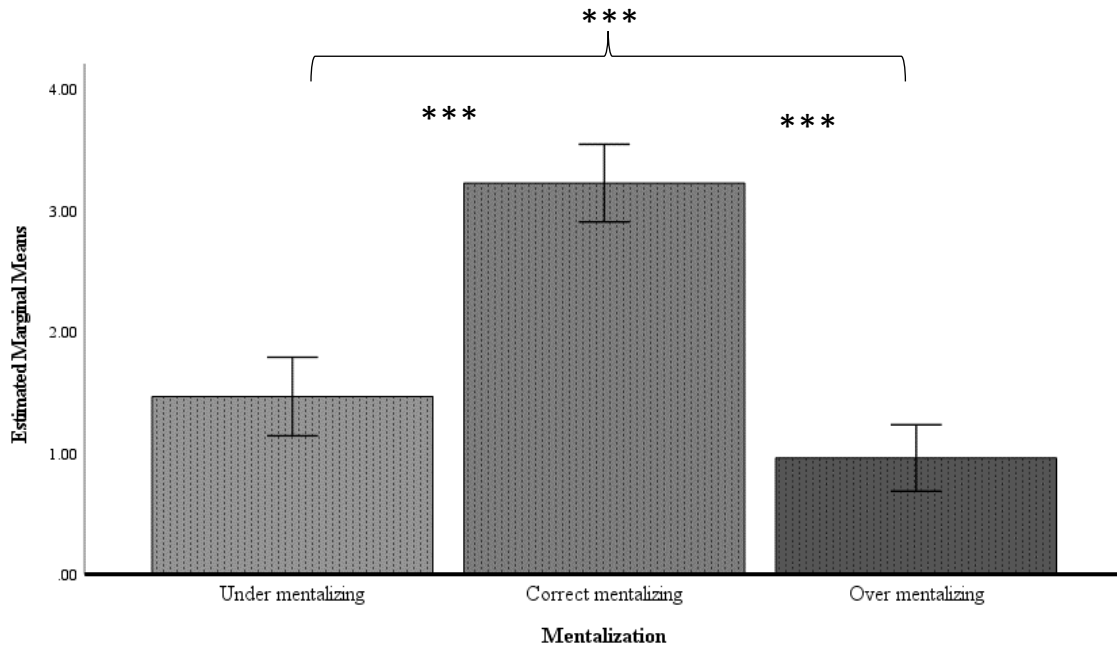


Figure 1. Total responses by mentalizing categories (95% confidence intervals).

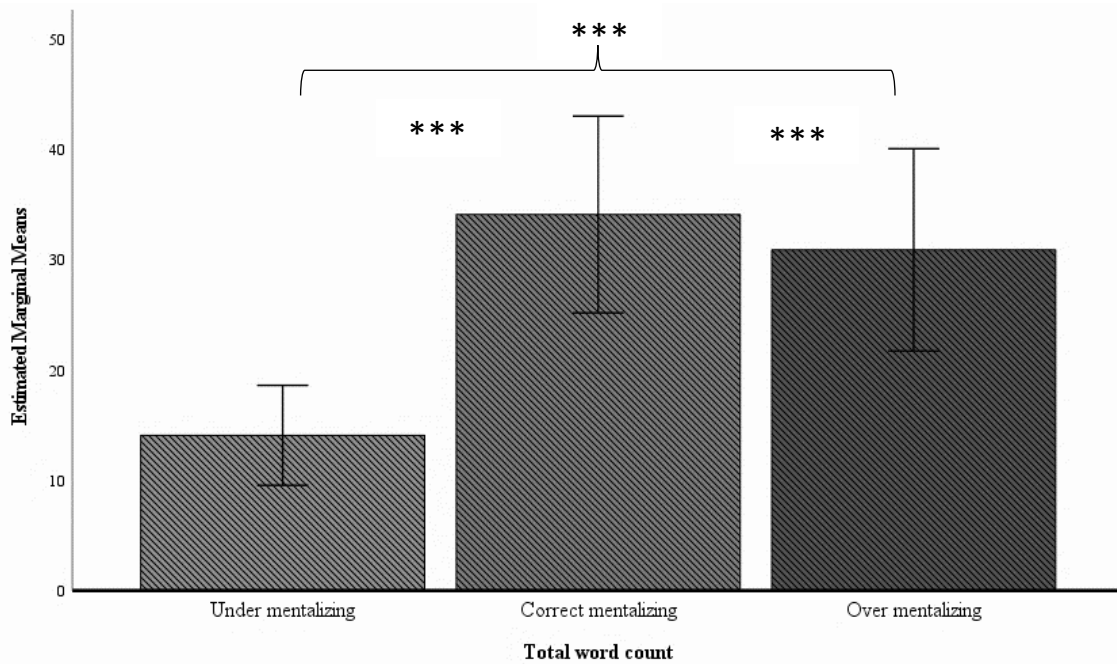


Figure 2. Total word average by mentalizing category (95% confidence intervals).

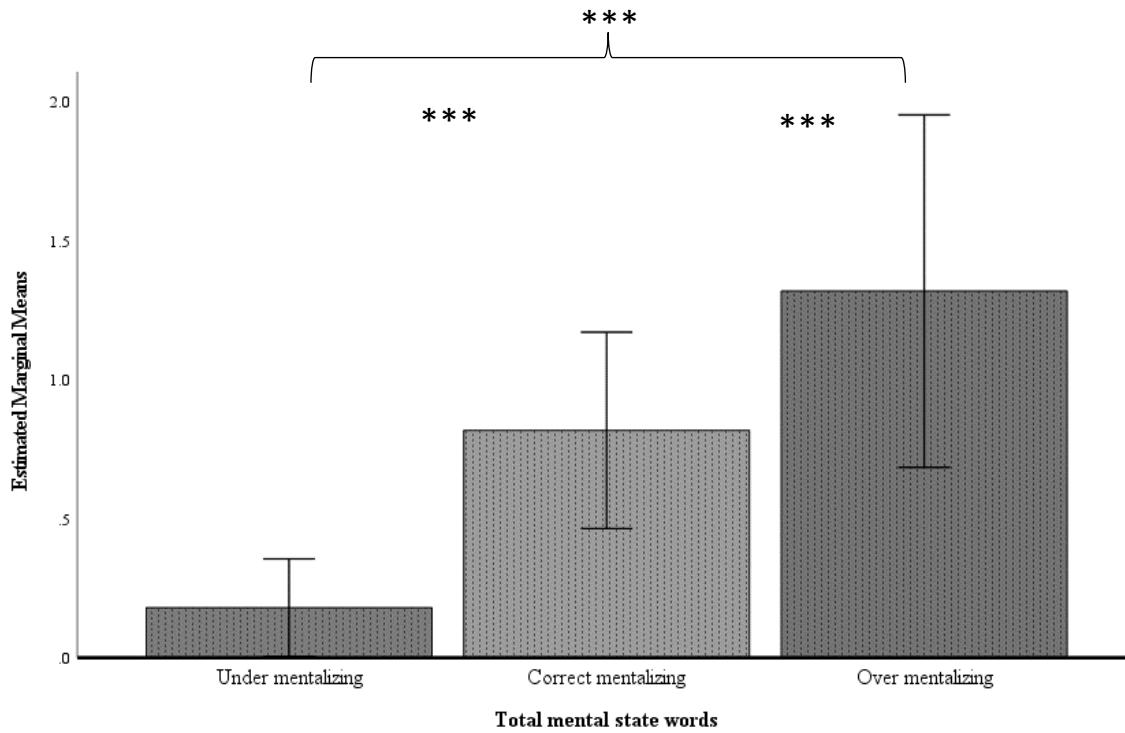


Figure 3. Total mental state word average by mentalizing category (95% confidence intervals).

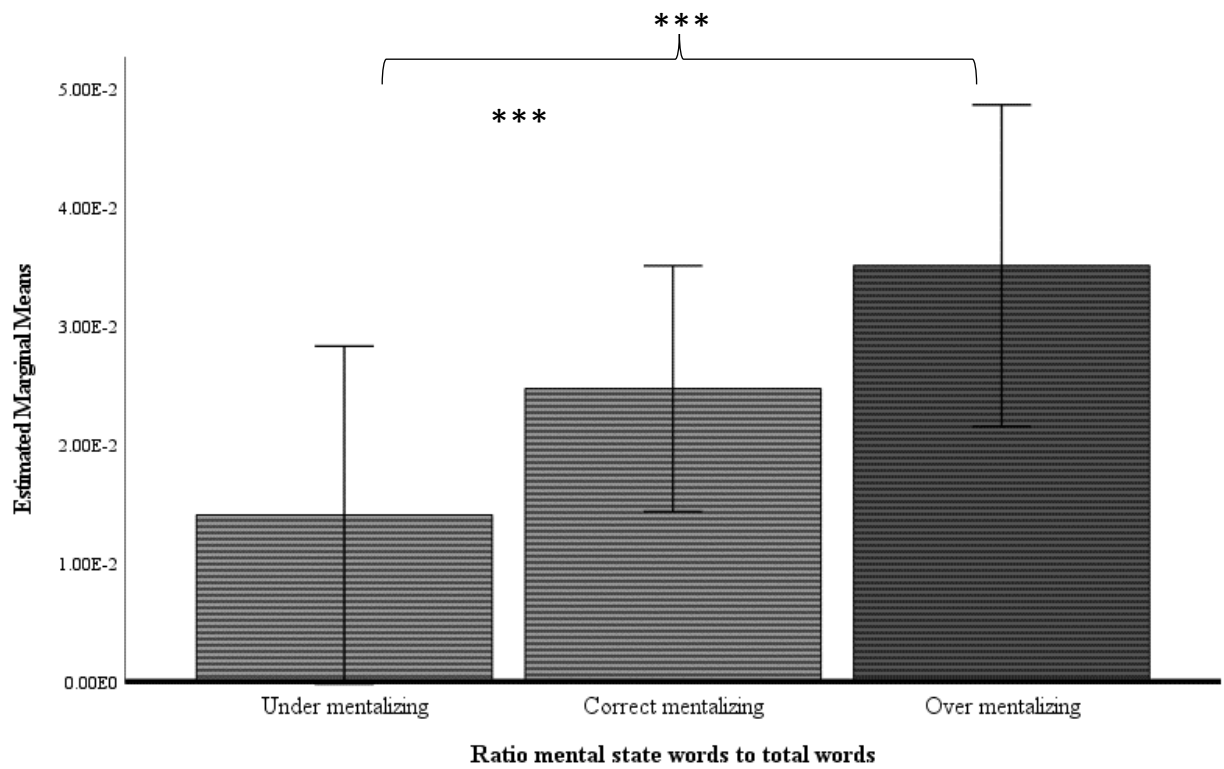


Figure 4. Ratio of mental state words to total word count by mentalizing category (95% confidence intervals).

Table 1

*Zero-order correlations of T1 social anxiety to dynamic emotion identification task mentalizing responses*

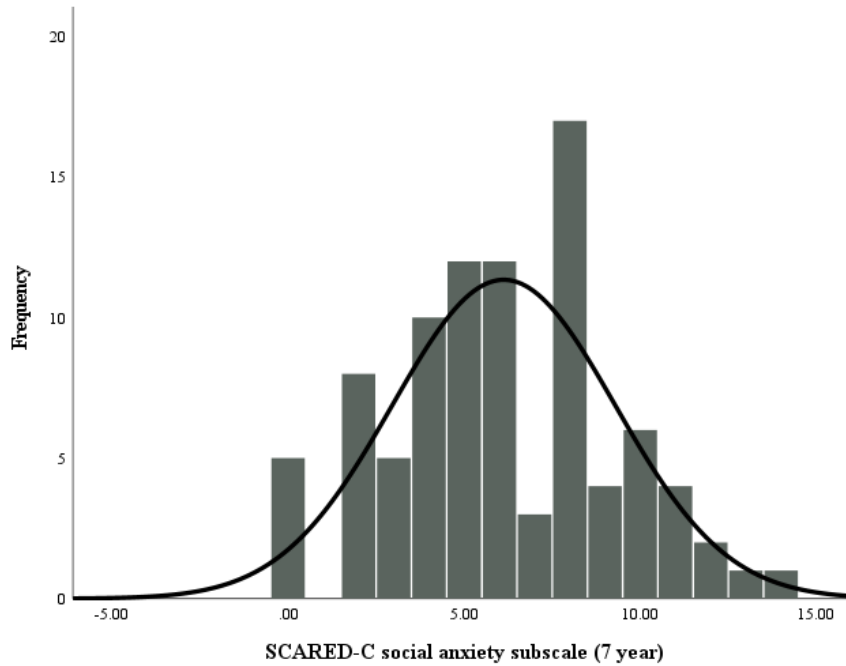
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. T1 social anxiety	-									
2. Under mentalizing total words	.13	-								
3. Correct mentalizing total words	-.04	-.30*	-							
4. Over mentalizing total words	.20	.23	.02	-						
5. Under mentalizing mental state words	-.01	-.07	-.08	.02	-					
6. Correct mentalizing mental state words	-.09	-.19	.46	.12	-.06	-				
			***							
7. Over mentalizing mental state words	.18	.32	-.06	.68	.16	.23	-			
				**						
8. Under mentalizing mental state to total words	.01	-.20	.01	.12	.85	.04	.27	-		
					***					
9. Correct mentalizing mental state to total words	-.09	-.03	-.04	.15	.06	.79	.37	.13	-	
						***	*			
10. Over mentalizing mental state to total state words	.01	.07	-.07	.17	.17	.25	.73	.24	.36*	-
							***			

Note: \*  $p < .05$ , \*\*\*  $p < .001$ .

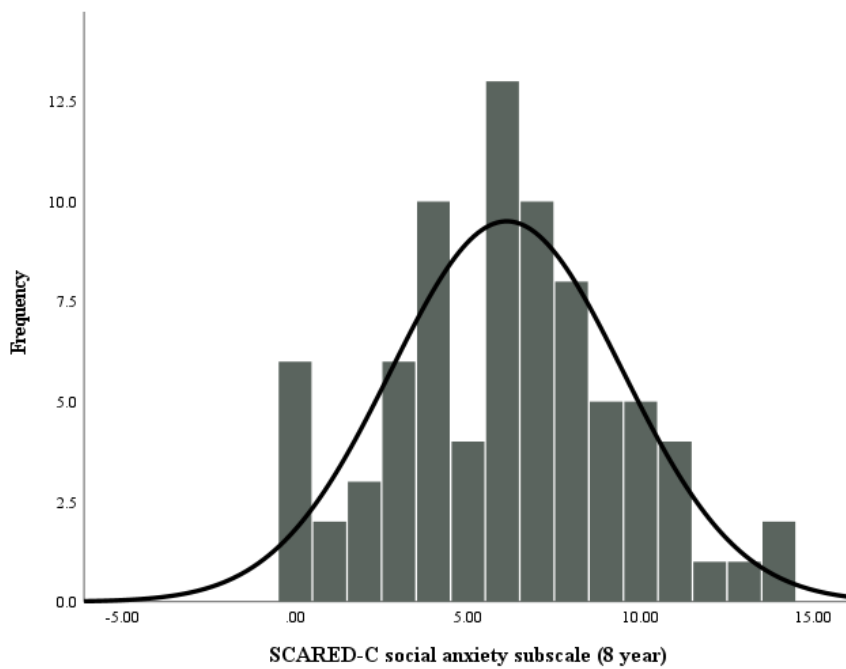


## Appendix C

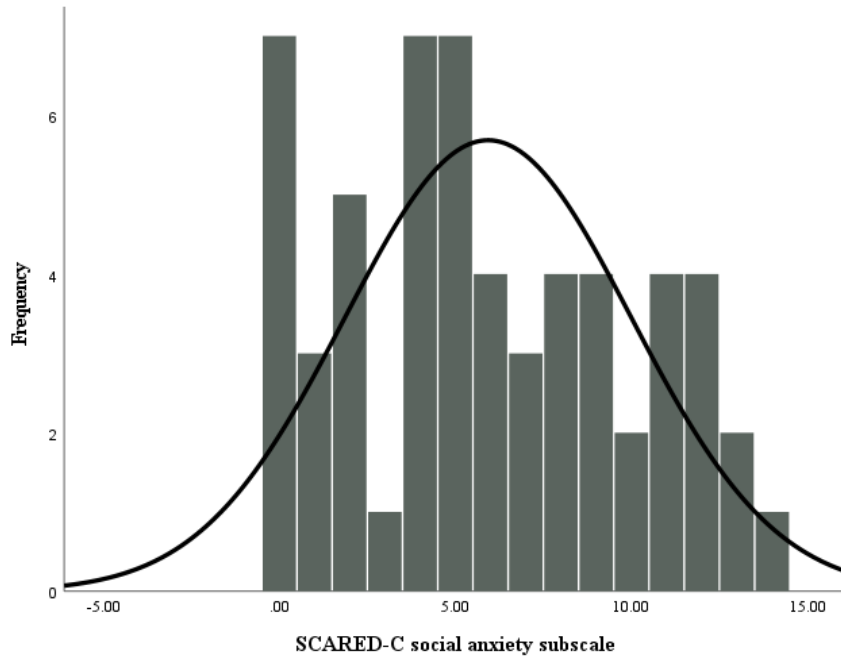
### Distributions of SCARED-C social anxiety subscales.



*Figure 1.* Distribution of SCARED-C at age 7 (Chapter Two and Three), skewness of 0.10 (SE = 0.25) and a kurtosis of -0.40 (SE = 0.50).



*Figure 2.* Distribution of SCARED-C social anxiety subscale at age 8 (Chapter Two), skewness of 0.10 (SE = 0.27) and a kurtosis of -0.28 (SE = 0.53).



*Figure 3.* Distribution of SCARED-C social anxiety subscale for Chapter Four, skewness of 0.20 (SE = 0.31) and a kurtosis of -1.03 (SE = 0.62)

## Appendix D

### Response type to Mentalizing Task (Chapter Three)

One-way ANOVA and Tukey post-hoc analysis revealed significant differences between the selection of the three evaluation expectations choices:  $F(2, 186)=291.59$ ,  $p<.001$ ,  $\eta^2=0.27$ . A Tukey test revealed that neutral expectation responses ( $M = 6.90$ ,  $SD = 3.03$ ) were selected, on average, more than either negative expectation responses ( $M = 2.73$ ,  $SD = 3.00$ ,  $p<.001$ ) or positive expectation responses ( $M = 4.98$ ,  $SD = 2.89$ ,  $p<.001$ ). Furthermore, positive expectation responses were selected more than negative expectation responses ( $p<.001$ ).

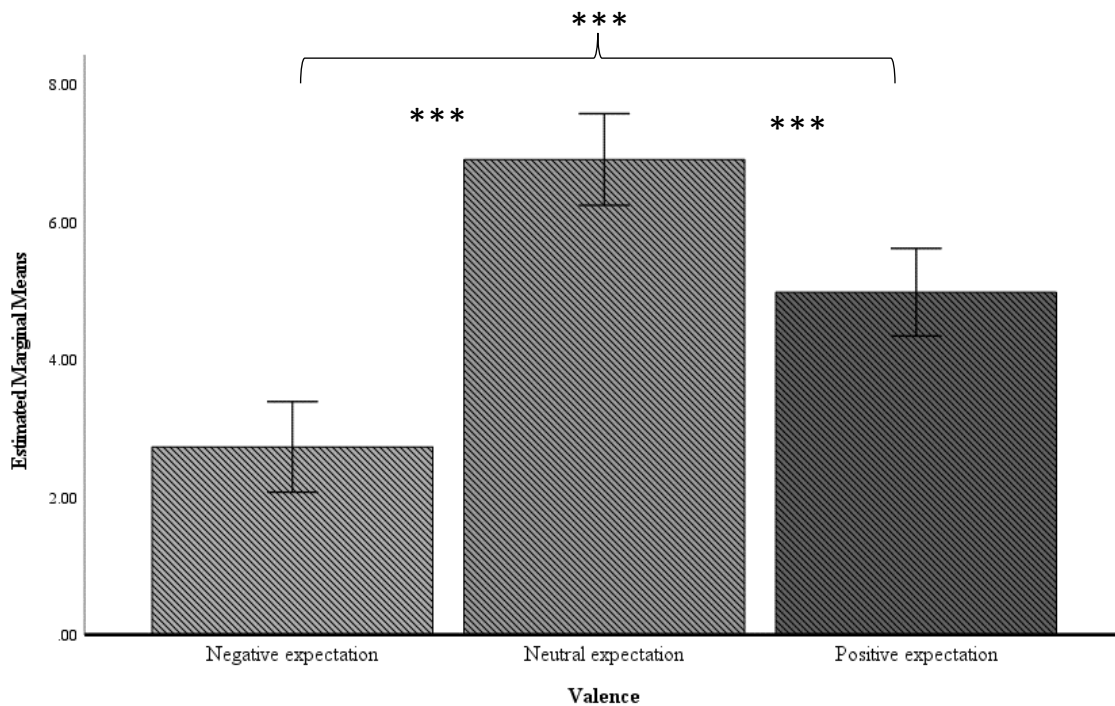


Figure 1. Response type by expectation of evaluation valence (95% confidence interval).

## Appendix E

### Response type selection to Mentalizing Task (Chapter Four)

One-way ANOVA and Tukey post-hoc analysis revealed significant differences between the selection of the three valenced evaluation expectations choices:  $F(2, 180)=314.16$ ,  $p<.001$ ,  $\eta^2=0.34$ . A Tukey test revealed that neutral expectation responses ( $M = 7.45$ ,  $SD = 2.74$ ) were selected, on average, more than either negative expectation responses ( $M = 3.29$ ,  $SD = 2.93$ ,  $p<.001$ ) or positive expectation responses ( $M = 3.97$ ,  $SD = 2.34$ ,  $p<.001$ ). There was no significant difference in response selection between negative expectation responses and positive expectation responses ( $p>.05$ ).

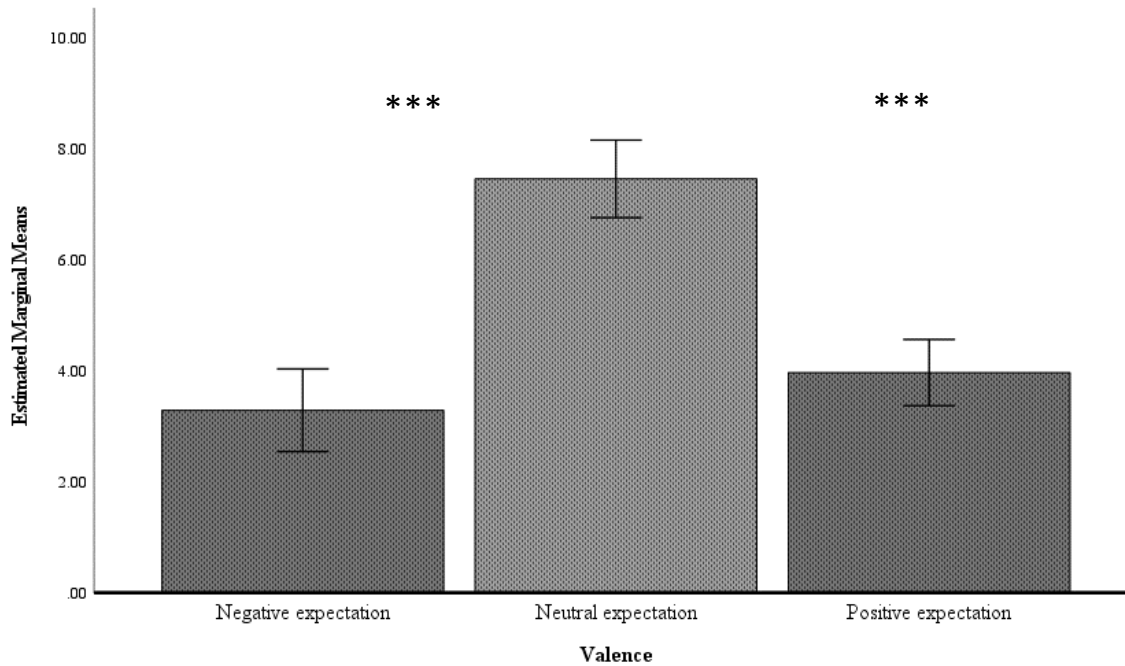


Figure 1. Response type by expectation of evaluation valence (95% confidence interval)

## Appendix F

### Coding Scheme for Get to Know You Task (Chapter Four)

#### *Global rating of Openness*

- 1=completely inappropriate (frequent staring or never looking at peers; orienting physically away from peers, i.e., turning around in the chair)
  - *Actively disengaged- shows no interest physically (body turned away, eyes averted the entire time, head down, phone on entire time, no active listening)*  
*When engaged by someone- they ignore or choose not to answer- may also provide an answer, but showing no comfort in doing so (eyes away, stiff, mumbling)*
- 2=mostly inappropriate looking away, but a few instances of appropriate interaction
  - *Body may be angled away slightly throughout or a lot for some of the interaction. Little eye contact, doesn't really pay attention to the conversation, even when they are involved – makes it harder for the other people to talk to them*
- 3=appropriate about half the time, may be directed at one person the entire time, but excluding the other
  - *May be only interested half the time overall – doesn't pay attention when others are talking, looking away around the room instead of being involved*
- 4=A few times when engaging in inappropriate interaction, mostly open to interaction
  - *Open, but occasionally may “close off” i.e., avert eyes, cross arms, talk to one person (for a bit), paying attention to the conversation and occasionally showing interest (nodding along, “ya”), but may daze off a bit even when the conversation is not on them*
- 5=totally appropriate (looking away and/or not physically oriented to peers when not interacting and looking at peers and/or physically oriented to peers when interacting)
  - *Super open, awesome eye contact and generally comfortable and engaged in the conversations with both people – body is open (i.e., face towards people, arms not crossed, not stiff) eye contact when talking and appropriately lacking eye contact when the conversation is not with them, attentive listening (nodding along, “ya”) even when the conversation is not involving them*

NOTE: sometimes it can be hard to see the eye contact from the person on the left of our target child. In this case, focus on the movement of the head and other bodily movements

### ***Global rating of Social Ease during interaction***

- 1=Appears uncomfortable during social interaction; displays anxious behaviour most of the time; little to no spontaneous affect
  - *Not engaged/avoidant towards interaction- anxious behaviours are visible and clear throughout the interaction- affect is almost non-existent: they are straight faced the entire time or head may be down on the table away from everyone or on the phone the entire time in a way showing they are nervous and uncomfortable. Any crying or signs of distress are automatically a 1.*
- 2=Displays mostly anxious behaviours and flat affect but may occasionally show comfort in social interaction
  - *Uncomfortable, and just trying to get through the interaction. Body is often fidgeting or tensed up- affect is extremely lacking or extremely inappropriate (i.e., Laughing/smiling when shouldn't). Head may be down a lot, but they are still present*
- 3=Appears comfortable in social interaction about half the time
  - *Okay with the interaction- not fully comfortable in behaviour and positioning (body may be tensed, or fidgeting a lot), doesn't seem to want to engage, but will engage when directly involved- more forced*
- 4=Mostly comfortable in interaction; may display some anxious behaviours or more limited affect
  - *Good with the interaction, gives off some uncomfortable behaviours (leg shaking, tapping, etc.), but still engaged and pleased with the interaction*
- 5=Displays comfort during social interaction, including flexible affect and no anxious behaviours
  - *Comfortable body position- relaxed, but engaged in the interaction – comfortable with the people and talking to everyone as a group- no leg shaking or any anxious behaviours- seems to actually enjoy the conversation and the interaction*

NOTE: Anxious behaviours include *fidgiting, looking away, playing with a cell phone, shaking leg, tapping fingers, wringing hands, inappropriate affect (laughing) etc.*

**Global rating of Appropriateness of Conversation/Interaction** (A code of 1 is suitable for triads in which no child speaks for the entire segment.)

- 1=rarely appropriate conversation
  - *No talking- silence. No questions, comments, or shares. May nod occasionally but gives an overall impression they are not engaged/involved in the conversation.*
- 2=a few appropriate moments, but mostly awkward/inappropriate; minimal seeking of information from peers
  - *May respond but does not ask questions or rarely does this. If talking to only one person, they are hogging the conversation, providing too much detail, or respond with info unrelated to the topic. May be focused on one topic and not accepting a change in topics (e.g., Minecraft forever even when others are not engaged or involved).*
- 3=appropriate half the time/responds well but minimal real effort to maintain the interaction- trouble maintaining flow of conversation
  - *May respond or ask questions a few times. May talk to only one person a lot- in this case- they would be all variables of a five, but since they are not including the other participant, they are not being appropriate enough and therefore are marked as a 3*
- 4=a few times inappropriate or a little trouble maintaining flow of conversation
  - *Asks and responds to questions well, may interrupt or hog the conversation a bit, less effective than a 5 – i.e., response may not be provoking, may give too much info, can't quite keep the conversation going even though they try to- may be slightly because of their skills, but generally because others are not participating. May admit defeat if ignored.*
- 5=shows appropriate conversational skills throughout
  - *Constantly (and appropriately) talking to everyone – not “hogging” the conversation, but genuinely seeking and sharing information (adding to other's stories, responding to questions, asking questions, following up with more*

*information or questions). Not providing too much detail (e.g., not telling their entire life story, but giving them enough to go off on), not interrupting, giving opportunities for others to speak and having good listening skills. Person may still be trying to get the conversation going, but due to the others not being engaged, they are left short. May try to keep the conversation going with another topic if peers are not engaged enough.*

NOTE: Appropriate conversation skills include:

- *talking when it is their turn and giving opportunities for the peer to speak*
- *speaking and listening to both peers equally*
- *taking half of the responsibility for maintaining and continuing the conversation*
- *answering and asking questions appropriately*
- *topics initiated are appropriate to the situation*
- *responses and sharing of information are appropriate - not giving too much personal information about self or others*
- *not interrupting or speaking over a peer*



## Appendix G

### Descriptive Analyses for Get to Know You Task (Chapter Four)

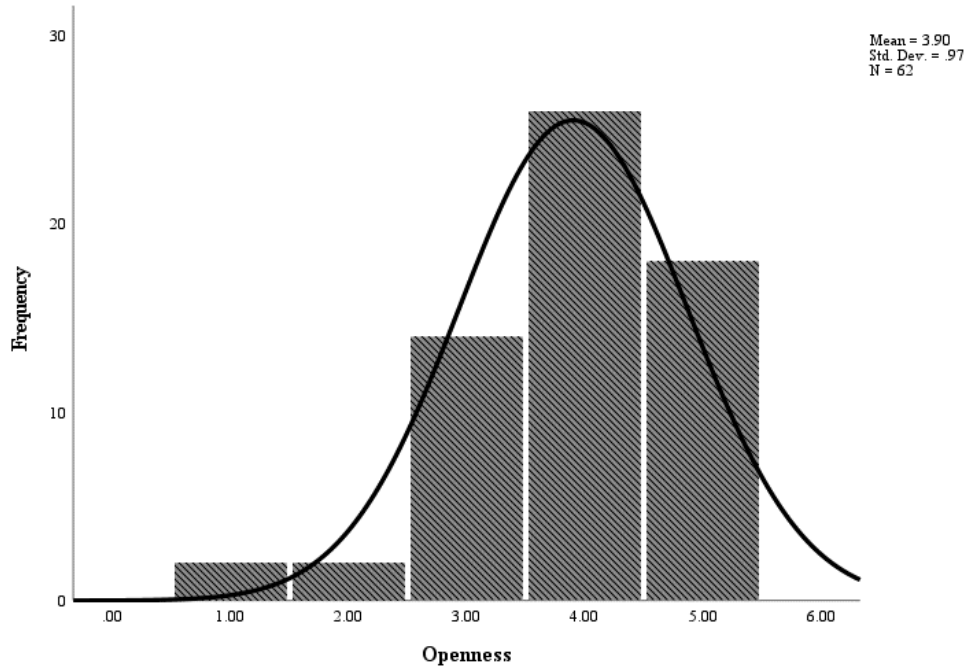


Figure 1. Frequency of scores for Get to Know You global code of Openness (rated on 1-5 scale).

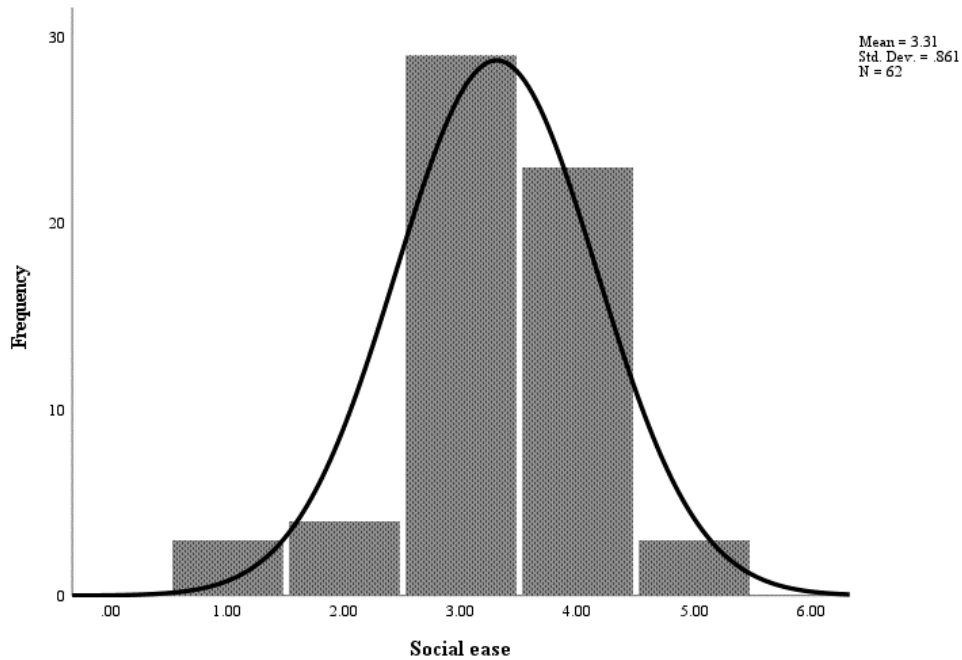


Figure 2. Frequency of scores for Get to Know You global code of Social Ease (rated on 1-5 scale).

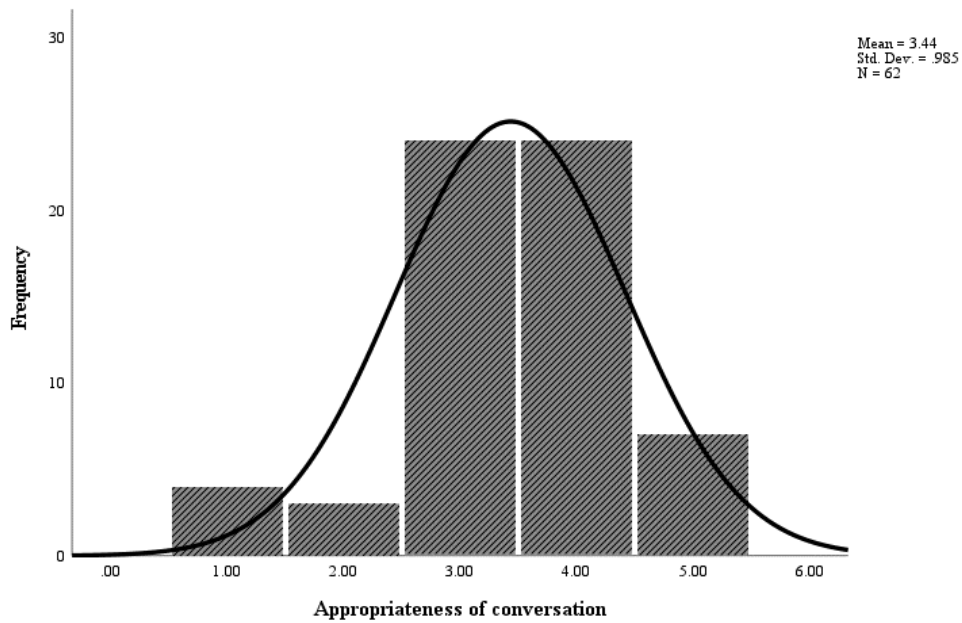


Figure 3. Frequency of scores for Get to Know You global code of Appropriateness of Conversation (rated on 1-5 scale).

Table 1

*Zero-order correlations between Get to Know You scores, and gender (Chapter Four)*

	1.	2.	3.	4.
1. Sex	-			
2. Openness	-.23	-		
3. Social Ease	-.36**	.70***	-	
4. Appropriateness of Conversation	-.29*	.51***	.73***	-

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Sex: 1 = female, 2 = male.